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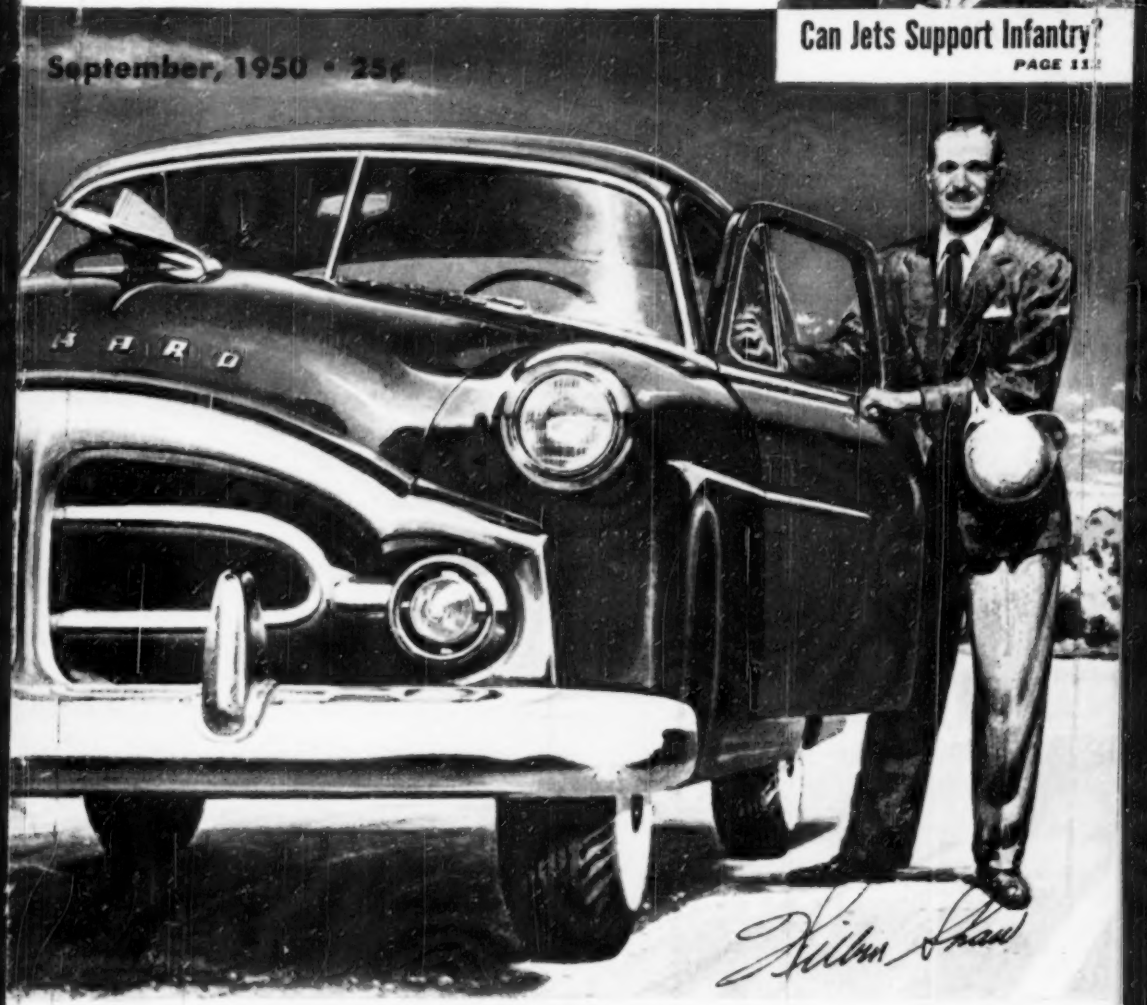

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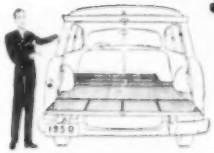

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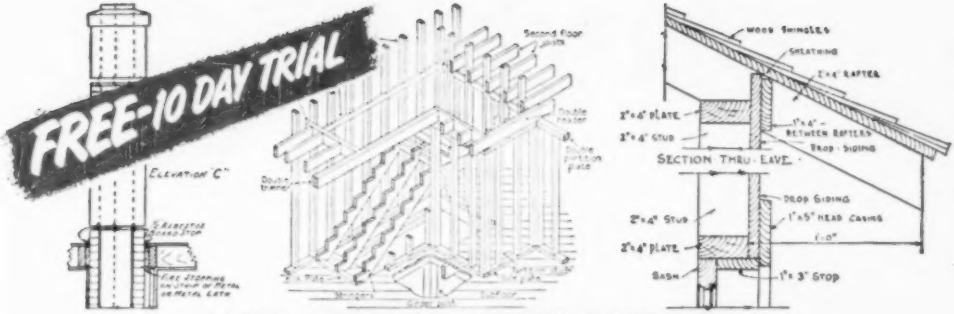

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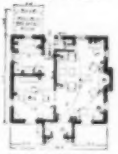
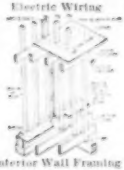

Electric Wiring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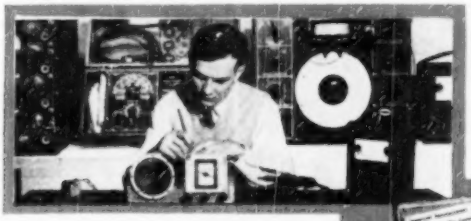

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Letters

Better Safe than Sorry

Sir:

If the article, "Making the Death Seat Safer," in the July issue of PS [p. 82] has the usual result—that is, a number of readers put into practice what your magazine preaches—it should be pointed out that potential danger is involved in facing an automobile's passenger seats to the rear.

A seat without a back high enough to support the passenger's head (and for most adults, that means any regular car seat) may have the same effect as a hangman's rope in the event of a sudden stop. The human head will pivot forward and downward quite easily and safely, but snapping it back can break the neck.

On the other hand, if the seat backs are made high enough to support the head safely, they may seriously obstruct the driver's vision to the side and rear.

Also, the Cornell Aero Lab recommendation that the major portion of a car's weight should be ahead of the passenger compartment is in marked contrast to the recent complaints of one of the consumers' test organizations (Consumers' Research). That group says that the present weight disparity between front and rear wheels of upwards of 500 pounds in some cases—the front being heavier—is dangerous from the

point of view of tendency to skid and lack of traction on slippery surfaces.

Furthermore, the progressive crumpling of the front of the car advocated by Mr. Dye's group sounds as if they are asking for even more and bigger repair bills than now plague the late-model car owner.

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doesn't do much good to build it so that it is unsafe or impractical for ordinary driving.

GEORGE W. ASHMAN, JR.

West Hartford, Conn.

Edward R. Dye, Chief of the Development Division of the Cornell Aeronautical Laboratory, who supplied the basic material for the article, answers Mr. Ashman:

Sir:

Reader George W. Ashman, Jr. has some good points about not sacrificing the roadability and handling qualities of a car for crash safety alone. There is no sense in increasing crashes just because we are trying to make cars safer.

The design of a passenger automobile must, of course, be a compromise considering safety of operation (roadability, handling qualities, vision, etc.), crash-safety cost, and utility. I would be the last one to recommend that we reduce any of the desirable stability characteristics of the modern automobile and I believe the center of gravity location should be governed primarily by its effect on car handling.

As pointed out by Mr. Ashman, a safer method of supporting the human in the rearward facing seats would be to include a support for the head. The neck is stronger in the forward direction (we have test data showing no injury up to greater than 35 G).

Also, we have a large number of records of parachute jumps where 'chute-opening shocks are greater than 15 G with no injury to the wearer. In these jumps, the snap of the neck can be in any direction, depending upon the position of the jumper at the instant of 'chute opening. I agree that the neck is weaker in the rearward bending direction, but accident records indicate that it is amply strong in this direction to resist the forces applied in this direction during a crash, say the equivalent of 300 pounds force for a 30-G crash. I believe a hangman's rope, mentioned in Mr. Ashman's letter, is arranged with a knot on the side of the head to give the neck a side snap. The person is usually dropped some six feet to be stopped by a prestressed rope which probably yields about 1" or 2" under the impact.

The human neck is relatively weak in transverse bending and this sort of loading delivers to the neck of a 200-pound man a peak force of some 7 tons or the equivalent of a 1,000-G deceleration to a 14-pound

INVENTORS

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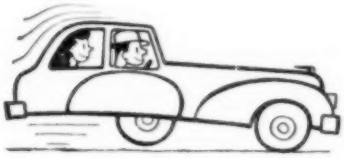
head. There is quite a difference in the G forces we are talking about.

To list the types of body support in order of crash safety, I would arrange them in the following order:

1. Rearward facing, body and head support.
2. Forward facing with seat belt and shoulder harness.
3. Rearward facing, body only supported.
4. Forward facing with seat strap alone.
5. Forward facing, rear seat with no support harness.
6. Forward facing, front seat with no support harness.

To answer the paragraph on the position of center of gravity, I would say that to maintain the center of gravity at its correct position for good control of the car and at the same time to have as much weight ahead of the passenger as possible, the passengers could be moved further back.



Of course, this will probably raise the problem of the quality of the ride received so there will be need of a compromise of the three requirements.

In our work here, we feel that crash safety can be best served by making the passenger compartment of the vehicle so strong that it remains intact during the crash but with the structure between the impact point and the passenger compartment so constructed that it will fail progressively, with failure of the members controlled so that they do not project into the passenger compartment. They should fail in a manner to absorb as much of the impact energy as possible and thus relieve the forces on the driver.

We have used the word crumpling loose-

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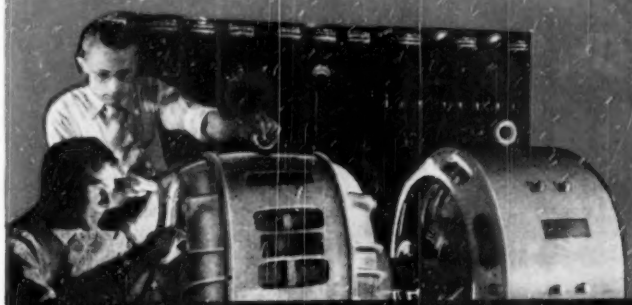

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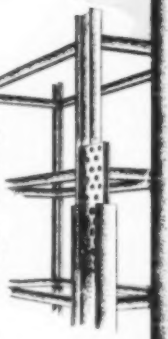

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ly, with no intention of having cars made any weaker than they are. The crash forces we are talking about are ones great enough to seriously injure or kill a person, and they are well above the range of serious damage to the car. We are guilty of thinking, if this type of crash does come, of "tearing up the old jalopy but sparing the child."

EDWARD R. DYE
Chief, Development Division
Cornell Aeronautical Laboratory
Buffalo, N. Y.

Missing Protons No Mystery

Sir:

I read your article "What Is the H-Bomb" in the April issue of POPULAR SCIENCE [p. 141] and I think it is very interesting. However, I believe you made an error when you pictured the fission of a uranium atom into praseodymium and a zirconium atom. Praseodymium and zirconium could not be a typical pair of uranium-fission products because the sum of the protons in an atom of each is equal to 99, whereas there are only 92 protons in a uranium atom . . .

DARWIN M. FECHLIN
Seymour, Wis.

Several readers counted protons before and after and found they didn't tally. The explanation is this: A typical uranium fission first yields krypton and barium, which decay radioactively. Stable zirconium and praseodymium result. The PS drawing omitted the intermediate steps, intending to show only the total energy released.

Nice, But Not Needed

Sir:

The woodturning article in the December POPULAR SCIENCE [p. 225] is a good one, but leaves out what I consider a vital lathe part—the ball-bearing dead center.

The conventional dead center is a nuisance. The cost of a ball-bearing center is very little compared with its usefulness. If for any reason I could not have one, I would simply stop my woodturning.

W. H. MOORE
Hanover, N. H.

A ball-bearing dead center is nice to have, but is by no means necessary. Our article was on woodturning techniques, not lathe accessories.

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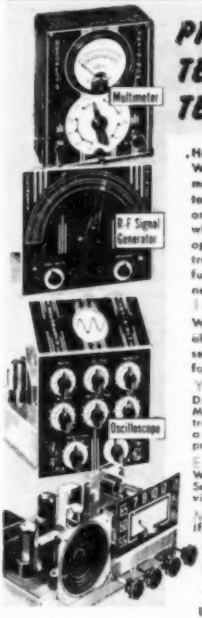

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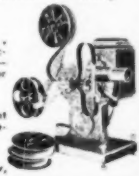

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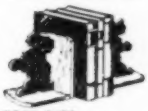

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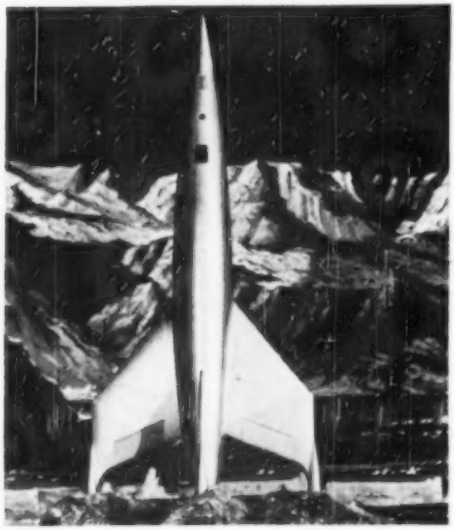

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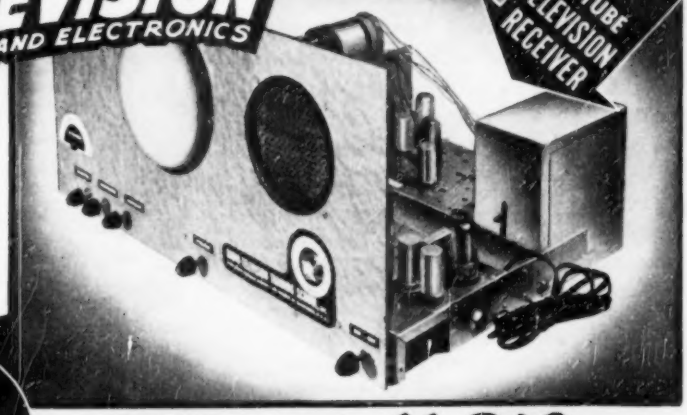

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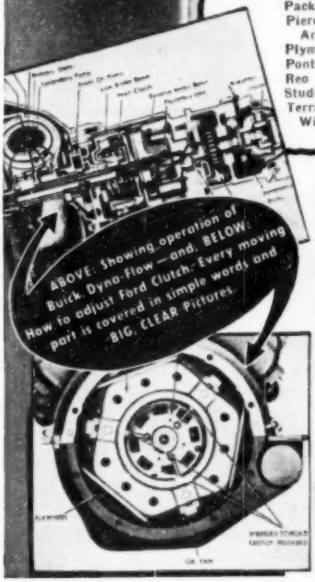

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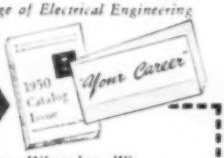

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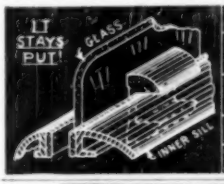

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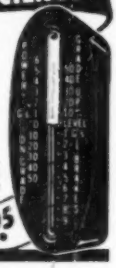

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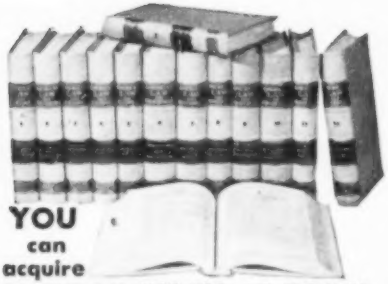

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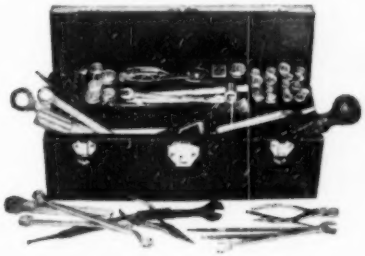

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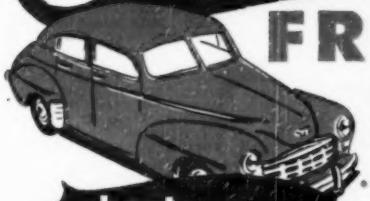

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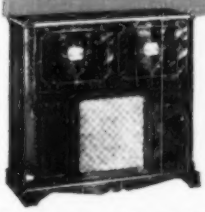

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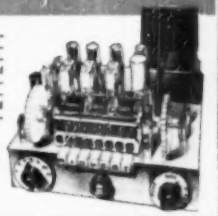

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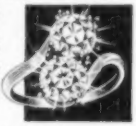

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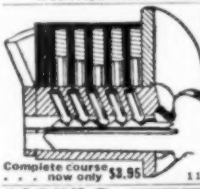

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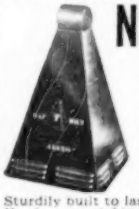

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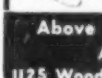

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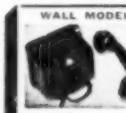

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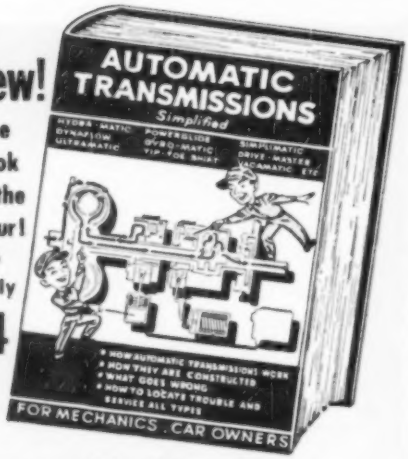

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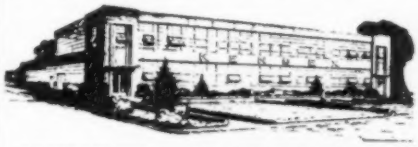

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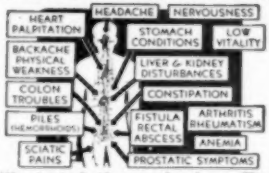

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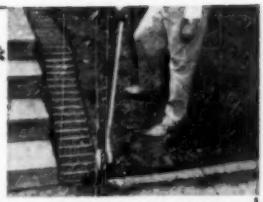

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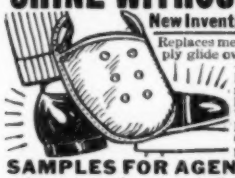

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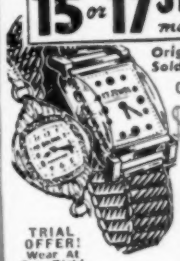

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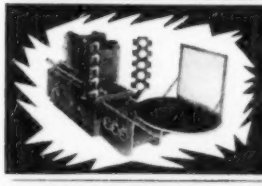

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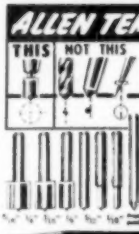

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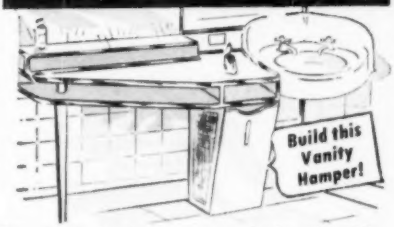

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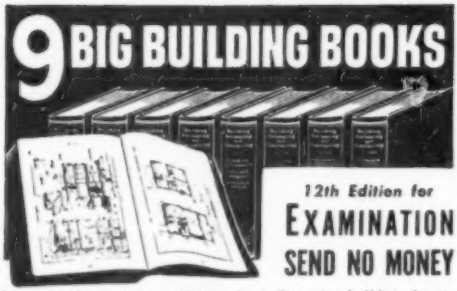

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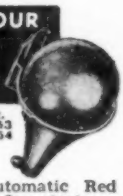

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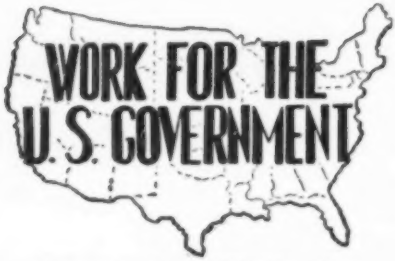

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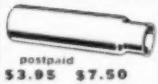

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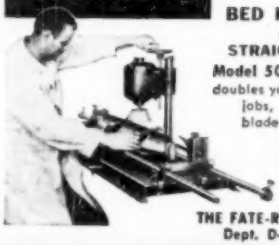

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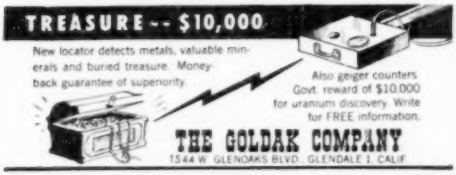

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YES, MAKE $7.65 on 10-second demonstration to merchants. Write on glass with amazing magic crayon and presto—a 5-color advertising message takes fire and glows like a brilliant neon sign! Three sales a day and $22.95 profit is for "lazy" men. Workers can double to triple that amount. FREE SALES KIT. Don't wait. Rush your name and address on a penny postcard for full details and complete sales kit—ALL FREE.

MAXILUME CO., 125 W. Hubbard
DEPT. L-99 CHICAGO 10, ILLINOIS

NOW EASY TO START
A Big Business
ON A SMALL INVESTMENT

WARNER SUCCESS PLAN

Gives exact instructions showing you

● How to start in spare time ● How to use home as headquarters ● How to bring in the business ● How to do real METALIZING in genuine GOLD, SILVER, or BRONZE, by the easy Warner Method ● How to start without risking your job ● How to pyramid your profits ● How to be sure of steady, big income.

Don't turn this page until you've given serious thought to your future. In the uncertain years ahead, the men who own their businesses are the ones who will be happiest. A small start now easily can lead you to complete independence, freedom from time clocks, freedom from fear of lay-offs, freedom from the limits of a pay check.

Now, while you can do it without risk—now is the time to investigate the exceptional opportunity offered you by the Warner Success Plan. Looking into the market, checking up on the possibilities for big sales and big profits will not cost you anything. Isn't this the time to lay the foundation for a future of complete independence—a life of happiness—a steady, dependable income?

METALIZING BABY SHOES AND OTHER KEEPSAKES

offers an exciting new opportunity to men or couples who want personal independence

If you'd like the feeling of being boss instead of being bossed—the Baby Shoe business is made to order for you. Just think of the appeal. A mother's love for her child—her desire to preserve forever the tiny shoes in which her baby took its first toddling steps. No wonder orders come easy and fast. No wonder profits are big. Then think of the Future. Fifteen Million babies in the last five years—three million last year—millions more next year. As long as babies are born, this business will prosper—in good times or bad. Think of the fun. Every job is different, interesting. And when you deliver a job and collect the money, you get a tremendous glow of satisfaction out of the mother's happy exclamations over your work. There's not another business I know of that offers you such big rewards in cash, in security, in a future, in independence that can be started on such a shoestring. You'll be glad you saw this ad—IF YOU SEND THE FREE COUPON.

READ THE ENTIRE PLAN

7 DAYS AT MY RISK

DON'T SEND A PENNY NOW—Just Send Your Name

This is one of the most fascinating businesses you can imagine. There are 15 MILLION pair of baby shoes waiting right now to be METALIZED. The opportunities are unlimited. The future is very big. And it's a business in which the whole family can have fun helping. A perfect business for man and wife to start—or for two partners. And I want you to read the whole Plan at my risk. Don't spend a cent unless you go ahead.

I want every serious minded man to let me show what I've done in our own shops here in Chicago—reveal the exact facts about the profits to be made and the way to make them. I don't want you to spend a cent for supplies until you've studied the facts, talked them over with the family and satisfied yourself that this is the ONE BIG OPPORTUNITY FOR YOU. That's why I allow you to read all trade secrets contained in the Warner Success Plan at My Risk. If you don't go ahead, you don't pay a cent.

You Have Nothing to Lose

ALL FACTS FREE! MAIL!

Raymond E. Brandell, Mgr., Warner Electric Co., 1512 Jarvis Ave., Dept. 2-P, Chicago 26, Ill.

As long as it doesn't cost me a cent, I am willing to read the facts, investigate, then give you my decision. Send the facts by next mail. Everything you send now is FREE!

NAME _____

ADDRESS _____

CITY _____ Zone ____ STATE _____

$5.00 AN HOUR

Yes, it's possible for one man to turn out enough work to make $5.00 an hour for his time. Think of how that pyramids when a partner or the whole family works.

Old Established Firm Backs You Up

The Warner Electric Company just celebrated its 25th year of success. You get a *Real Start* when you "join up with Warner"—you get real *Guidance to Success.*

Warner Electric Co., Dept. 2-P, 1512 Jarvis Ave., CHICAGO 26, ILL.

WE SUPPLY EVERYTHING

You don't have to go "hunting" when Warner is behind you. We supply all materials, all mounts, chemicals, and metals. And you get the low prices made possible by our big quantity purchases and our own manufacture. You send for just what you need—and never have any big investment tied up in stock.

Classified Ads only 80c per word per insertion, payable in advance. Minimum ad 10 words. To be included in November issue, copy should be in our office by September 22nd.

CLASSIFIED OPPORTUNITIES

POPULAR SCIENCE MONTHLY-353 FOURTH AVE.-NEW YORK CITY 10

1 AUTOMOBILES

ENJOY New-Car pep and power in your old Buick. Same day service from world's largest stock of new (not rebuilt) Buick parts and engines. Ship anywhere. Dime brings catalog. Write today. Robertson Buick Co. 1002 S. Wabash Ave., Chicago 5, Illinois.

SILENCE Overhead-valves. Attachments unnecessary. $2.00. Derderian, Box 542, Sandston, Virginia.

"WATER Injection." Also-Speed-Power-Economy-Methods! Free illustrated information. Neher Industries, La Verne 6, Calif.

SAVE Gasoline, oil, tires, brakes—New Illustrated Economy Manual. Get more power, speed, better automobile performance. Introduces 17 new Economy products —Super sparkplugs, Water-oil Injector, Rocket booster, Mileage motor, etc. Special 50c. National Automotive Research Corporation, Venice 19, California.

YOUR car burn oil? Poor compression? Slow starting? Excessive cylinder wear? Holt's Piston Seal restores compression! Cuts oil consumption! Checks piston slap! Lasts 10,000 miles! This amazing British Product now available forms self-expanding pliable lubricating seal around pistons. Compensates for wear! Cannot harm finest engine. Easily installed; full directions enclosed. $3.98 tube for 6 or 8 cylinders up to 240 cubic inches. Free details. Treglown Company, 200 West 7th Street, Plainfield 2, New Jersey.

R-A-C-I-N-G Equipment from California—Speed-Dress-Up Accessories for e-v-e-r-y make passenger automobile. Racing Ignitions, Carburetors, Flywheels, Camshafts, Water Injectors, Mufflers, Crash Helmets—Thousands of items in stock! Dual Manifolds (for Willys Jeeps to Oldsmobile Rockets)—Finned Hi-Compression Heads—covering 155 different makes and models. "1950 Illustrated Equipment Catalogue"—plus "Driving Economy"—25c. (Dealers, request Wholesale Catalogue). Newhouse Automotive Industries, 5805-A, 7 East Beverly, Los Angeles 22.

"SPEED And POWER" Handbook—128 enameled pages! Covers all makes of cars! Sixty Breathtaking Chapters, Including "Jet Propulsion"—"Racing Frames"—"Wheel Geometry" "Dynamometers"—"Reciprocating Masses"—"Gear Ratios" "Dual Pipes" "Fuel Formulas"—"Porting" —"Balancing" —"Lowering" —"Relieving." Authentic—by Automotive Engineers. Shows exactly how to build your own Dual Manifolds, Superchargers, Hot Cams, Water Injectors, Hi-Compression Heads, Mileage Devices! Save many dollars! Get up to ten more miles per gallon —racing speed, lightning acceleration, dynamic power increases from any make passenger automobile! Build fast Stock Cars, California Roadsters, 160 M.P.H. Rods! Includes construction drawings! Tuning Techniques! Speed Tricks! Economy secrets! Ingenious formulas! Includes, "California Automobile Customizing"—Photographs (Newest ideas). Conversions (Re-styling all makes). Also, "Speed Equipment Picture Catalogue." Plus—new "Economy Handbook." Plus "Injection Information." 300 Illustrations. Five items —$1.98 postpaid. Newhouse Automotive Industries, 5805-A, 2 East Beverly, Los Angeles 22. (see page 38).

"GENUINE Crosley Parts." Factory Rebuilt Engine with Cast Block $109 exchange. Block kits $77.15. Water pumps, packies $9.25. Hydraulic brake kits $75. Clutch plates $5.75. Parts books $1.25 Postpaid. Glenn Walraven Motors, "King of the Crosleys." Marion 2, Ohio. Phone 2-4135.

"IF You Want To Go Let Us Know" Complete Line of Sport's Car, Stock Car, Road Car Equipment. Illustrated Catalog 25c. Dealers Wanted. Hi-Speed Power Equipment, 228-26 Merrick Road, Laurelton L. I., N. Y. La-5-9535.

CALIFORNIA Custom accessory headquarters. Buy direct from original designers and save. Chrome dash panels, solid hood sides, grille panels, speed equipment, dual pipes, push button door conversions, chrome motor accessories, fender skirts. 34 page illustrated catalog 25c. Eastern Auto, 7319D, South Grand, Los Angeles 7, Calif.

"SPEED equipment". Lowest prices. Handbook-catalog 25c. Sped-O-Motive, Covina 5, California.

MIDGET Auto Plans $3.00. 178 Home, Farm machinery easily built from salvage materials. Descriptive Handbook 25c (Refundable) Free Details. KIMO, Box 307-PS, New York 19.

NEW Book "Special Racing Cars and Hot Rods of the World." 160 photographs, charts, drawings. Complete mechanical information cars of all nations. Supercharging, engines, suspension, transmissions. A "must" for every race car enthusiast. Postpaid, $1.50. Clymer, Dept. B-9, 1268 So. Alvarado, Los Angeles 6, Calif.

NEW Book. "The Sports Car Engine." Complete information speed tuning, design, maintenance all sports cars. Postpaid, $1.50. Clymer, Dept. B-9, 1268 So. Alvarado, Los Angeles 6, Calif.

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CHEVROLET Speed Catalog (Illustrated) Finest proven equipment for increasing mileage, power and all-round performance '37 thru '50 models. Only 25c. California Bill, 4411 York (Dept. A-9) Eagle Rock, California.

FREE Booklet!! May save your life! No obligation! Levin Accessories, 720 Princeton Ave., Trenton, N. J.

"SPEED Equipment" Bargains—Hollywood Mufflers $4.50. V-8 Duals $15.90. V-8 High Compression Heads $23.50. Chrome Carburetor Stacks 98c. Dual Manifolds $9.95. Chrome Tailpipe Megaphones $1.55. Racing Camshafts $29.95. Water Injectors $12.95. All Popular Brands—Big Illustrated Catalog 25c (Dealers Wanted). Almquist Engineering, Milford 33Z, Pennsylvania.

"S-P-E-E-D & Mileage" Manuals—"New Deluxe 60th Edition. World Famous Power Book. Endorsed By Champions!" Covers Speed, Power, Economy, Increasing For All Passenger Cars—Shows Speed Equipment Construction—Speed Tuning—Race Car Building—California Hot Rod Plans—"Custom Restyling"—Sports Car Conversions—Etc. "Easily Get Terrific Power, Mileage, Acceleration—Top Racing Performance From Any Car!" Shows Inexpensive Ways To Build Speed Equipment, Superchargers, Dual Manifolds, High Compression Heads, Dual Mufflers, Racing Cams, Water Injectors, Economizers—"Save 75%!" Complete Instructions With Working Diagrams On Engine Rebuilding, "Souping-up" Restyling, "Customizing", Gas Saving, "Racing Tricks", Fuels, "Cam Secrets", Balancing, Porting, "Jet", Formulas, Ratios, Frames, "Offys"!—"Learn 100 Ways To Save Gas"! Reveals "Stock Car Speed Secrets"! California Speed Shop Methods! Covers "Hollywood Custom Styling"! Streamlining! Lowering! "Sport Changes"! "Roadster Plans"! Blueprints! 200 M.P.H. Conversions—Fords, Chevs., Plys.—All Makes! 320 Illustrations—"Guaranteed Finest"! (Worth $10.00)—"Big Manual" plus Speed Equipment Catalog, plus "Hot Rod Handbook"—All Three Books $1.98. Almquist Engineering, Milford 31Z, Pennsylvania. (See display ad page 86).

1951 HOT ROD & Racing Equipment Catalog plus "Speed Secrets" Handbook—(1000 Items, Pictures, Instructions—All Cars). Both 25c. Almquist Engineering, Milford 34Z, Pennsylvania (dealers request wholesale catalog).

2 AUTO SUPPLIES & EQUIPMENT

BRUSH Plating Outfits connect to a battery. No tanks or shop required. Free particulars. Gunmetal Co., Avenue K, Decatur, Illinois.

NEW "Economy and Power" methods—Free. Neher Industries, La Verne 6, Calif.

NEW and used guaranteed parts for civilian and Army cars and trucks. Largest stock in America. Mail orders. Pioneer Auto Wrecking Company, 788 W. 13th Avenue, Denver, Colorado.

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MOTORISTS save gasoline by Vacumatic overrich mixtures. Fits all cars. For Free particulars write Vacumatic, Dept. 1641, Wauwatosa, Wis.

STOP that rattling auto window! See page 28, Rolexco.

GET extra profits on repair work. Do your own welding. Easy to use. Easy pays for itself terms. Catalog Free. Hobart Welders, Box P-905, Troy, Ohio.

WHEEL alignment recorder. Drive-over, $18.95. Guaranteed. Particulars free. Salesmen wanted. Align-A-Matic, Box 94C, West Orange, N.J.

JUST Out! Get largest auto accessory and parts catalog in world. Over 15,000 items, including Hollywood accessories, hi-speed equipment, rebuilt engines; all parts and accessories for all cars, trucks. New used, rebuilt! We have the hard to get part! Completely illustrated. Jam-packed with bargains. Send 25c. J. C. Whitney Co., 1919-T Archer Ave., Chicago 16.

CHEVROLET Parts. Scarce motor, body, sheet metal parts. Grossman Chevrolet, Minneapolis, Minnesota.

DIESEL Conversion Burns Kerosene. Easy Installation. $24.95. Buckley, Taunton, Mass.

3 AUTO TRAILERS

BUILD Your own Trailer. Save Money. Have every feature you want! Plans for house, sport, camp and utility trailers. Catalog describing 9 models 10c. 15c in Canada and overseas. Jim Dandy, Box 125-B, Wausau, Wisconsin.

4 MOTORCYCLES BICYCLES, SUPPLIES

1936 INDIAN twin $10; Harley 61 $35; Doodlebug motorscooter $15; Salsbury $35. Motorscooters less meters $9 up; meters $3 up. Power lawnmower $12. Four Balloon tires $3. Mailorder only. Send 25c for catalogue Number Thirty-seven, just out, listing these and hundreds of other bargains in midget cars, motorscooters, parts, plans, transmissions, engines, war surplus, etc. Midget Motors Directory, Athens, Ohio.

WORLD'S Most efficient Motor bike. Has 8 horsepower Motor. Cruises easily on 45 m.p.h. Gets 110 m.p.h. Costs only $205. Send 10c for Literature. Joe G. Young, Rte. 3, Elba, Alabama.

KNEEACTION Moto-Scoot $10; motorbike (front and rear brakes) $5; Whizzer motorbike with clutch and all attachments $25; Indian motorcycle $30; good midget car $35; tire-wheel combination $2.50. Rush 25c (35c for first class mail) for new catalog #945 listing sensational bargains in motors, motorscooters, motorcycles, Servicycles, midget cars, etc. Associated, Box 1764-CS, Toledo, Ohio.

MOTORCYCLE Magazine — Worldwide Coverage. Yearly Subscription $1.00. Sample 15c. Motorcycle News. 5424-H Sawyer, Chicago 25.

SPECIAL—1946 Whizzer in Schwinn bicycle $20. Also Cushman motorscooter (good tires and lights) $15; Shaw bicycle motor $15; midget car $15. Rush 25c (35c for first class mail) for new catalog 317 listing many other amazing postwar bargains in wheels, engines, motorscooters, midget cars, monocycles, motorettes, etc. Gall, 538 Erie, Toledo, Ohio.

5 AVIATION

PROPELLERS. Plans supplies for ice sleds, snow sleighs, air boats. Literature 20c. Banks-Maxwell, Box 3301, Ft. Worth.

7 ELECTRICAL SUPPLIES & EQUIPMENT

32 VOLT appliances. World's largest line. Catalog Free. Haines Corporation, Dept. P, Minneapolis, Minn.

ELECTRIC Pencil Engraves all Metals $1.25. Beyer Mfg., 10611-C Springfield, Chicago 43.

LAMP Parts. 24 hour service from most complete stock in country. 25c brings 60 page catalog with charts and instructions for building and repairing. Discount to dealers. Gyro Lamp, 5402 B Clark, Chicago 40, Illinois.

BUILD your own electric motors from scrap automotive generators. Complete illustrated instructions for all makes. Only $1.00. Autopower, Dept. PS, 918 South Theresa, St. Louis 3, Mo.

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FREE Catalog—Motors, Generators, Welders from aircraft generators. Water Softeners, many other electrical bargains. LeJay Company, Minneapolis, Minnesota.

8 WELDING, SOLDERING, PLATING

SET up your own profitable welding business. "Build Your Own" portable arc welder with low cost generator. Free book tells how. Hobart Welders, Box P-902, Troy, Ohio.

RADIATOR Repairing Books, Supplies, Equipment. Gasoline Torch. Write for circular. Curlman Mfg. Co., Marysville, Mo.

9 AIR CONDITIONING & HEATING

CROSSBOWS. $39.95 up. Free Literature. "Schmidt." 1511 Gardner, Hollywood, California.

10 MACHINERY, TOOLS, SUPPLIES

DRILL Grinder for twist drills. $2.95. See ad on page 272.

POWER Tools. Big savings when you build your own with Lewis castings. 23 wood and metal working tools with blueprints. Most can be completed with lathe and drillpress. Commercial quality. Ideal for home shops, schools, small manufacturing. Catalog 10c. Lewis Machine Tool Co., 3217 Union Pacific Ave., Dept. S, Los Angeles.

SHEET Metal-Hobbyists-Machines. Punch, Brake, Nibbler, Slip Roll. Catalog. Montgomery, 53 Park Place, N. Y. C.

POWER tools, equipment. Wholesale prices. Free Bulletin. Homecrafters Cooperative, Grand Rapids 6, Michigan.

RESURFACE butcher's chopping blocks with easy, fast-working portable electric machine. Unique service in wide demand with little competition. Large, steady profits from full or part-time work. Hill Machine Co., Dept. P, 1041 W. State St., Rockford, Illinois.

13 BATTERIES, GENERATORS, ETC.

EDISON Nickel Batteries, 35 to 400 ampere. Also Kits with Edison Plates, make your own. Interesting literature. Hawley Smith Co., Croton Falls 2, N. Y.

14 BOATS, OUTBOARD MOTORS, ETC.

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NEW, used, rebuilt marine motors. Marine conversions, fittings. Free Catalog. Stokes Marine Supply, Dept. 23, Coldwater, Mich.

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BUILD a better boat than you can buy for the money with Ozarka's Exclusive laminated-rib construction and carefully pre-formed and pre-fitted parts. Save to 55% on all popular types from simple cartop models to one-design knockabout sailboats, priced from $39.50 to $329.00. Shipped complete, ready for easy assembly. Send 25c for literature, refunded on first purchase. Ozarka, Inc., 790 Borden Lane, Woodstock, Illinois.

SAVE 2/3 cost. Assemble your own boat. Complete plans and boat parts machined ready for assembly. No experience necessary. Rowboats to cruisers. Illustrated catalog 25c. Midwest Boat Company, Mechanicville Falls, Wisconsin.

MARINE conversions for Ford and Jeep engines. Catalog 10c. Lehman Manufacturing Company, Department A, Newark 2, N. J.

AUTO Conversions and Parts. Marine manifolds for all engines. V8—$40 pair; Model A$32; Willys $30; 6 cyl. Chevrolet, Pontiac $50; 6 cyl. Buick, Lycoming $65; 8 cylinder Pierce Packard $80; Your transmission converted to marine gear, most makes $40; propellers 14"—$13.50, 16"—$16.75; shafts, struts, couplings, etc. Everything you need for your boat. Money back guarantee. Conversion Parts Co., 277 Adams Street, Boston 22, Mass.

15 ENGINES, MOTORS, ETC.

WINDING Data, listing 225 motors, single and three phase, $1.00. Motor Data, Box 7621, Kansas City 3, Mo.

HOTTEST surplus list in the country. Electronics, Hydraulics, Aircraft, Gadgets, Dick Rose, Everett, Washington.

MOTORS 1 horse $35, ¾ $24, ½ $15. Twin cylinder compressors $17.50. Fans 32 volt $3.75. Butler, 1885 Milwaukee, Chicago 47.

MOTOR Winders, free bulletins, winding and testing equipment. Motor Industries, Quincy, Illinois.

16 AMERICAN POLICE JIU JITSU

DEADLY Judo—Fiercest fighting technique. Trick knockouts. (Over 200 illustrated pictures.) Expert instructions—Three volumes. Complete $2.25. Variety House, Box 46-A, Wall Station, New York 5.

18 BODY-BUILDING COURSES

BARBELLS. Build Muscular Bodies. Illustrated. Catalogue. Jackson Barbells, Springfield 7, New Jersey.

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SAVE 50%, on new binoculars! Free catalog. Free book, "How to Select Binoculars." Write today! Bushnell Importers, 43-P9 East Green, Pasadena 1, California.

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SEE Golden Hamster ad on Page 59. Shows picture of Hamster.

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32 PROFITABLE OCCUPATIONS

BE independent. be secure. have your own profitable business—earn $20.00 and more a day making beautiful. fast-selling lamps at home. No equipment needed. Illustrated course teaches you quickly. Course. parts catalog. wholesale price list —only $2. Gearon Co., Dept. 200-A8. 27 S. Desplaines. Chicago 6. Ill.

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$250 WEEK reported! Free illustrated book "505 Odd, Successful Businesses." Work home! Expect something odd! Pacific-E, Oceanside, California.

MAKE Perfume—at home—Men—Women write INTERNATIONAL, 6347 Parnell—PS-9, Chicago 21, Illinois.

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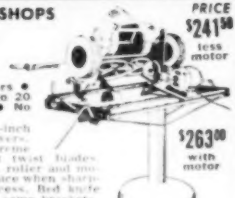

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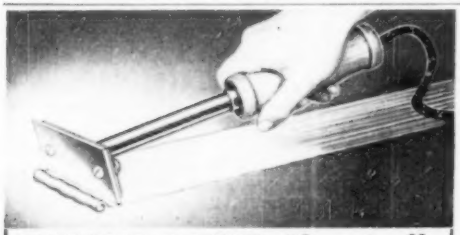

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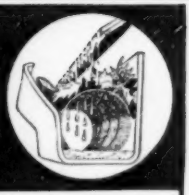

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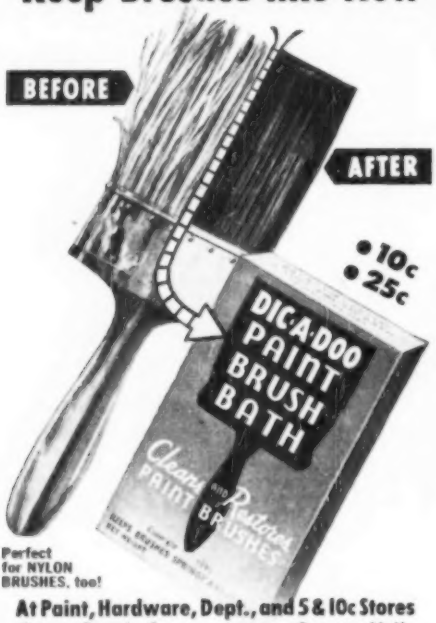

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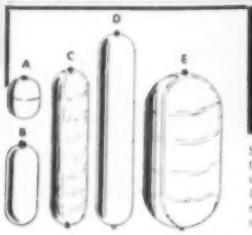

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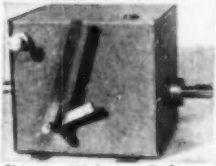

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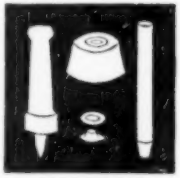

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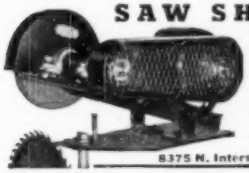

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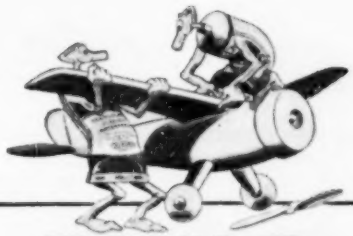

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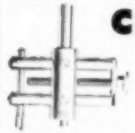

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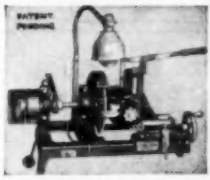

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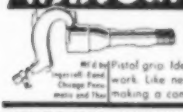

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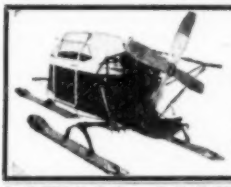

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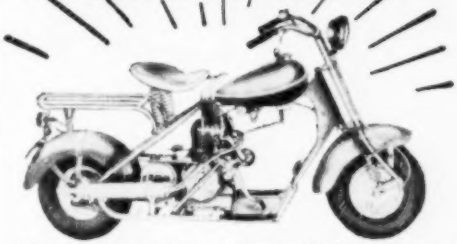

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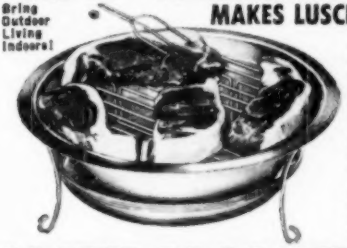

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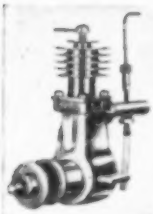

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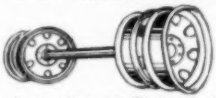

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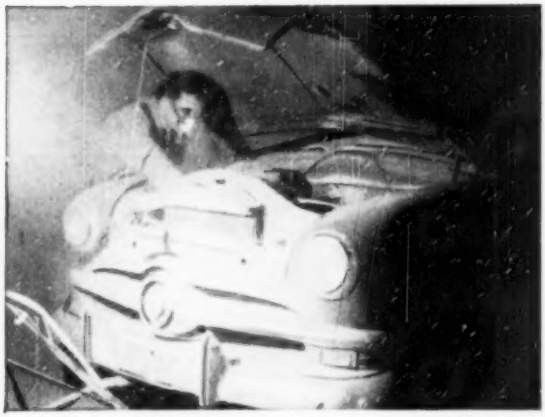
Popular Science *Highlights* this Month

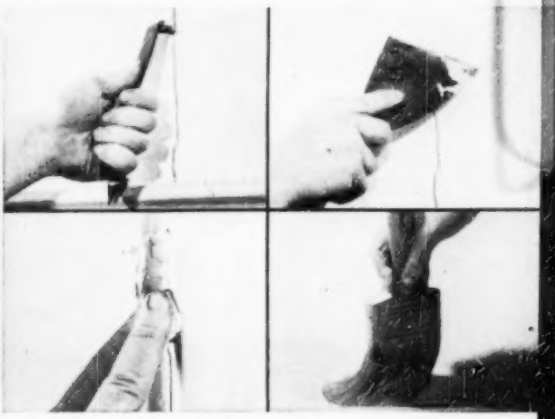
Driver's Report: Famous speed merchant Wilbur Shaw takes you for a 110-m.p.h. ride in the '51 Packard. **Page 100**

Vacuum Your Furnace: It won't hurt your wife's vacuum cleaner—and it will save you fuel and get the heat up faster. **Page 188**

Movie-Size TV from Your Old Set: New adapter gives you choice of three-by-four-foot projection or a direct-view image. **Page 232**



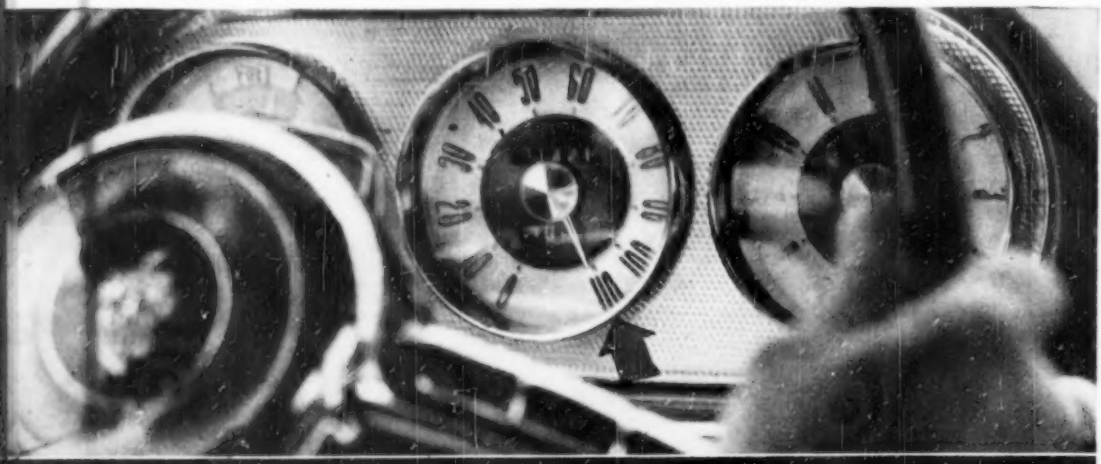
Dust Wrecks Cars: Come into one of the world's dirtiest laboratories and see an automobile engine commit suicide. **Page 141**

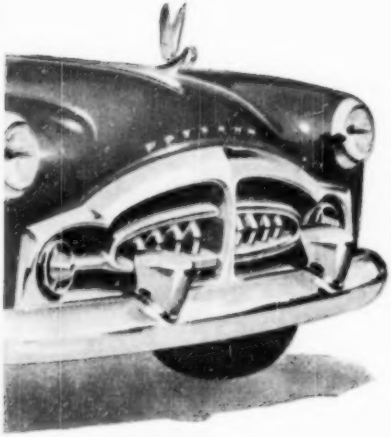


A Good Paint Job Is Simple: But it's what you do before the final coat that makes a professional decorating job. **Page 179**

This is the "Patrician 400," the fanciest entry in the company's 1951 stable. Under that low hood she's got 155 hp. The crankshaft in this straight-eight engine has nine main bearings.

I opened up the Packard on the Proving Ground track with Bill Morris and his camera in the back seat. The speedometer needle in the picture below is *past* the 110-m.p.h. mark. The photo at the bottom shows how a second speed run looked from the infield. The car is a "300" sedan.





REPORT FROM THE DRIVER'S SEAT . . .

Cover by Reynold Brown

Take a Ride In the '51 Packard

By Wilbur Shaw

PS PHOTOS BY W. W. MORRIS ON LOCATION AT PACKARD PROVING GROUND

EDITOR'S NOTE: *For his first* Report from the Driver's Seat, *Wilbur Shaw takes you to the famous Packard Proving Grounds in Utica, Mich. Climb aboard, and America's best known man behind the wheel will take you for a drive in the 1951 models. Other reports will come in succeeding months.*

WHEN Packard invited me to try out its new models, in deepest secrecy, I jumped at the chance. It offered three "firsts" with one jump:

A grand old name for my first assignment as automobile reporter for POPULAR SCIENCE.

A first whack at some brand-new cars, one of them with the highest compression ratio in the industry in standard-size cars—7.8 to 1.

A first work-out on the Packard Proving Ground private speed track. Ever since Leon Duray was clocked at 148 miles an hour in a 90-cu.-in. Miller back in 1928, I've wanted to turn a fast lap on that track. I figured it had to be something special for Duray to post a record that has stood for 22 years.

I was tickled to get a crack at these new cars because Packard's always had a name for advanced engineering, ever since the old Twin-Six. To tell the truth, I also brought along some misgivings, after I heard they'd boosted the compression. A lot of the wise boys don't think a straight eight likes high compression. The crankshaft's so much longer than a V-8's, they say, that it's likely to develop whip at speed. I wanted to see for myself.

Before I drove the new cars, Bill Graves, Packard engineering v.p., took me on a get-acquainted tour of the Proving Ground in the "200." This is the smallest of the new

I wanted to get a running record of my comments on this car. So I took along a recording set and put it on the seat alongside of me. The gimmick on my head that looks like it was swiped from a doctor's office holds the mike. I was surprised at some of my own comments while driving.

Packards, with a wheelbase of 122 inches. There's also a "300" and a "Patrician 400"—that's the fancy job at the start of this article. But let's take a ride and I'll try to give you my impressions as we roll.

When Bill turned into the track for a lively lap and a half, I began to see why the track was known for speed. Like the Indianapolis

The Packard people were out in force when we got to the Proving Ground. I'm the gent with his foot on the bumper. The man on my right is my old friend Ed Macauley, chief engineer of Packard styling division. Next to him is J. R. Ferguson, chief automotive engineer. On my left is William H. Graves, engineering v.p. who stood by all day, answering my questions.

Speedway, it's two and a half miles around. Its curves are parabolic. That enables you to turn the track up to 110 miles an hour with absolutely no side thrust on the car. If you're brave enough, you could take your hands off the wheel and let the car find its proper height in the turn. But this track would be no good for racing. There's only one high-speed groove.

Driving on a Ski Slope

Next, Bill Graves turned into the darndest labyrinth of twisting, winding, tortuous roads I believe I've ever seen. And I've hunted from a car in Arizona! Presently we came across a hill as steep as a ski slope. I made a note to try it myself with the '51 jobs.

Back at the office, Bill slid out of the car. It was mine.

Now, we all know that automatic transmissions are here to stay. But I still get a lot of satisfaction out of using a clutch. The "200" had one. It was smooth. It required only 16 pounds of pedal pressure, which is light. The travel of the gear-shift lever makes actual finger-tip shifting possible.

First go, I headed back five rough miles for that hill. The car felt good. The accelerator linkage was right—not too much travel but not too sensitive. The steering seemed high ratio; you had to wind it up and unwind it on a turn.

At this point I turned on my Dictaphone Timemaster on the seat beside me to record a running account of my impressions. Here's the playback:

Report from Behind the Wheel

They've given this car a soft ride. The shocks take the rebound well. On these washboard sections you get a solid feeling and not one that you're floating with the wheels on the ground only now and then. I like the idea of using warning lights in place of the oil-pressure gauge and ammeter.

My personal taste would be for a faster steering gear. High-ratio steering makes parking easier, with these wide-tread tires. But in these turns—they're practically switchbacks—I don't know. You have to turn this wheel a lot of times to . . . it takes a lot of turning to get around a bend.

(I'm going to have more to say in future articles about this steering problem.)

But she straightens out nicely . . . Just take the hands off the wheel . . . This car has excellent directional stability.

Wups, mudhole! There's the hill. It's cer-

Before we started driving we held a little confab on procedure. That's Bill Morris on the left. On the right is Devon Francis of PS's editorial staff.

tainly impressive. They tell me the steepest gradient is 35.4 percent.

I got out of the car to reconnoiter. Walking up the hill would be work for a mountain goat. It wasn't a long hill. But it was high.

I'll try it in low gear first. Not too fast. Up we go . . . Nice . . . Not a buck or a quiver or any laboring noises. I'm going to roll back down and try second gear. I'll get a little run for it. Let's not be unreasonable. At the bottom . . . Ten miles an hour. On the button.

Wow, she's cresting the hill like a thoroughbred!

I didn't try high gear. That would be asking just too much of any car. On the way back I couldn't resist the temptation to do a half-lap on the track. We went up to 90 miles an hour on the speedometer without giving the "200" a chance to really get its wind.

Trying Out Ultramatic

The "300" was next. It was a beaut. A heavier car with a 5-inch longer wheelbase. A two-pedal job—just a brake and accelerator. With the Ultramatic transmission the clutch pedal is gone.

Like most automatics, the Ultramatic creeps a little when you are trying to stand still with the selector lever in driving range. That may bother some drivers until they get used to holding with the brake.

Like the "200," the "300" is nicely appointed inside. The visibility is wonderful. The hood has been lowered to reduce the blind spot on the road in front of the car; and *you can even see your right fender!* Windshield pillars are very narrow. If you can't see out of these cars, you're blind and shouldn't be driving.

The "300" with Ultramatic has 155 hp. at 3,600 r.p.m. and she runs at 7.8-to-1 compression. That's squeezing it pretty tight for a passenger car, especially one with an L-head engine. L-heads usually don't take to high compression as well as overhead-valve jobs. But the boost ought to increase power and relative fuel mileage, provided they can maintain volumetric efficiency.

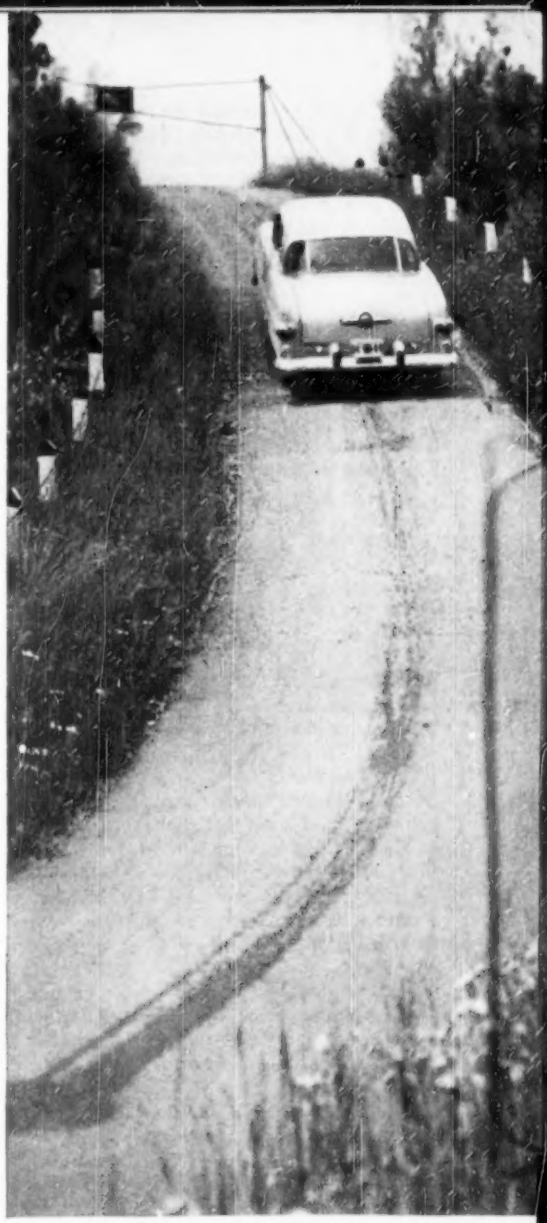
Crankshaft Is Stiffened

Packard's put *nine* main bearings, instead of the usual five, in the engine of their "Patrician 400" line. With the crankshaft beefed up, they figure to march right on up with compression ratios as better fuels become available.

One thing's for sure: they're going to have to keep carbon out of *any* of these high-compression engines, whoever makes them, or they'll cackle like a bunch of hens.

With Devon Francis, of the POPULAR SCIENCE editorial staff, and Bill Morris, the magazine's chief photographer, in the back seat, I drove toward the test course. On the way I did a little commenting:

I'm going to do a half-lap on the track just for fun. This job moves away as though we had steam for power. The engine speed re-



I told Bill Graves that I wasn't anxious to push his new car beyond its limits. That would be plain punishment. But he said to go right ahead. So I did. Here the car is performing a Herculean feat—holding fast on a better-than-35-percent grade with only the churning blades of the automatic transmission to support it. The oil trail is from backing down the hill after a previous run when oil dripped from the transmission breather due to the unnatural slant of the car. Nobody would ever ask a car to do this much. The picture really doesn't do the hill justice.

quired to get torque is a bit strange to me, but this is a characteristic of all torque-converter types of transmissions.

What I like is that you can get into direct drive in high range at practically any speed merely by easing off on the accelerator. In direct drive you have a mechanical connection between the engine and rear wheels.

They've done a nice job with this power plant. I can't resist pushing it a little. Registering 95. We haven't even reached the turn. For a car of this weight, with three of us aboard, that's moving right along.

We had to pull off on the inside and stop, before crossing the track to the rough ground. This was a safety measure on a busy track.

Could Use a Spinner

Here's one of those switchback turns. Whew! That's rough! But when I give her her head she straightens up. I've never liked those motormen's knobs that people put on steering wheels. But I could use one now.

There's a bit of a chuckle in the steering gear going over the washboard. Matter of adjustment.

Here are the thank-you-ma'ams and dipsadaisies. They're lulus! We're going fast enough . . . this is fast . . . she's taking it like a well-mannered boat in rough water. . . . This car has a good, solid feel, that's for sure.

Now, I'd like to pause here to say that these new torque-converter transmissions are just as new to me as they are to the average motorist. Remember, in racing cars we try to keep as many things *off* a car as we possibly can.

We headed for the killer-hill because I wanted to see what Packard's Ultramatic would do under these tough conditions.

This time, with three of us in the car and about a 15-m.p.h. run, we sailed up over that hill in high without a whimper. At the top I *reversed* momentarily to start backing down. Then I put the selector lever in *drive* position and let the car down, using forward driving power as braking power.

Transmission During Roll-Back

I've often wondered what would happen if an inexperienced person got stopped with one of these transmissions on a steep grade. Now I know about the only thing you could do wrong during a roll-back would be to put the lever in reverse and bang up the back.

After lunch Bill Morris wanted to get some speed pictures on the track. I was anxious, I admit, to see how it would perform in the speed department. I'm certainly not an advocate of high speeds on the highway. Let's get that clear. But speed is a rough measurement of power. And plenty of power lets people cruise at a reasonably high speed without punishing their engines.

Devon and Bill Morris, with his camera, got into the back seat.

I don't propose to make any acceleration tests with this car. It's not a hot rod. It's moving away from a full stop smoothly. These torque converters at the present state of the art are no match in acceleration for a good mechanical transmission. Correction—I mean with the lever in driving range. If you want a jackrabbit start, put her in low for the first spurt. Then flip her to "Drive." But, for me, that sort of thing outside of competition is silly.

Are you fellows set? Let's stretch this baby out.

110 m.p.h. and Going Up

There's your 100. We're still in the first turn. We're coming off the bank. We ought to find a few more knots now. We are. There it is! Got it, Bill? Hear me, back there? Got it, Bill? It's 110 on the speedometer. Going up, too. Let's see if she'll hold that through the turn. Yup! That's probably a good, honest 100, allowing for normal instrument error.

We actually picked up some more speed

This Month's Shaw-ism

The greatest safety device that will ever be used in an automobile is the knob a driver hangs his hat on.

Wilbur Shaw

even though the speedometer didn't show it. There's a smell to speed, if you've driven races. You can feel it in your engine revs and the way the terrain goes by.

It was such a soft ride that you couldn't even feel the expansion strips in the track. I swayed back and forth over the longitudinal strips to see how the car would react. She was stable.

As we slowed to a walk I glanced at the heat indicator. She wasn't sweating. There was no indication of temperature rise under the full-throttle running that she had done.

As we drove back to the office Bill Morris, running his fingers through his big shock of white hair, commented: "That's the fastest ride I've ever had on wheels."

For me, it wasn't the fastest, but it was one of the pleasantest. I'd finally driven that magnificent Packard track, and in a fine automobile. END

For a mechanical close-up of the new Packards, see page 120.

Remote Controls Run Pipe Line 1,000 Miles Away

A MAN at a desk in New York dialed a number on a teletype machine the other day, and opened valves and started pumps on a pipe line a thousand miles away. He was operating the world's first remote-control system for the "sequenced" flow of petroleum products between a refinery and cities served by the pipe line. The Shell Oil Co. needed such a system to prevent snarls in feeding and valving the line.

The pipe line—between the refinery at Wood River, Ill., and Columbus, O.—handles a great variety of products. It valves them off under pump pressure in any given quantity in response to the schedule sent by a dispatcher in the New York home office.

The system does more, however, than merely open and close valves and start and stop motors in response to dialed instructions. The dispatcher can find out how much of any product is being delivered at a discharge point by dialing another number combination. Automatically, he gets a teletype reply.

The coded teletype signals operate solenoids and motors. The dispatcher gets information on deliveries by an electric reading of suction and discharge pressures.

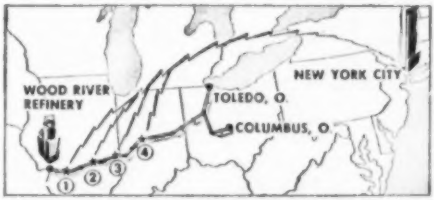
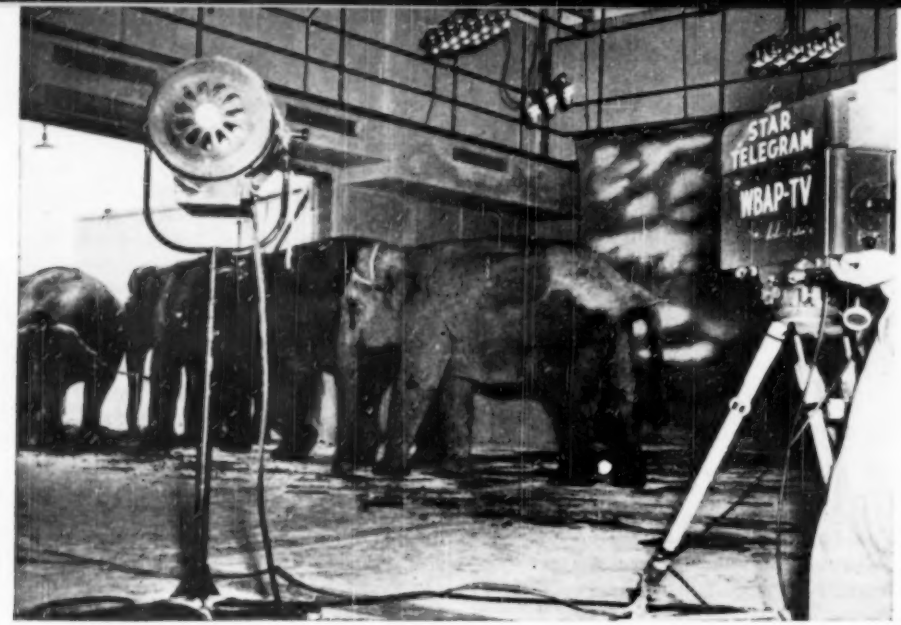


Diagram shows signal transmission from New York to pumping stations on Shell pipe line.

Dispatcher in home office skyscraper uses this dial system to transmit orders and get information at stations in New Douglas, Effingham, and Dennison, Ill., and North Salem, Ind.

With entire pipe line on diagram before her, technician records information on petroleum-products flow. System was devised by Shell, General Electric, and A.T.&T. engineers.



Elephants Fit on Big TV Stage

YUP, those are elephants in the television studio. There's room for these representatives of the Ringling circus—as well as herds of cattle, mounted cowboys, moving vans, prize-winning hogs, and big brewery wagons—on the unusual stage of WBAP-TV, of Fort Worth, Texas. The outsize performers walk through "Video Lane," a passageway made by cutting two 12-feet-high by 15-feet-wide doors in opposite outside walls of the studio.

Mercury Wagon Has Flat Floor

A FLAT floor from the driver's seat to the end of the tailgate permits carrying long or wheeled loads in the newest Mercury station wagon. To provide this space, the tailgate locks horizontally, the rear seat folds forward flush with the rear floor, and a removable floor board covers the inclined part of the floor. On the exterior, plywood panels have been replaced with mahogany-grained steel to increase the car's ruggedness. A similar panel is on the tailgate.

Telecast Movies Improved

THE movies you see on television should look better when helped by the two devices displayed above by O. B. Hanson, NBC chief engineer. The Orthogam amplifier (left) smooths the contrast range in 35-mm. theatrical films, improving the naturalness of skin tones particularly. The special Westinghouse high-intensity mercury lamp in his other hand adds sharpness and detail in 16-mm. "kinescope recordings"—movies of television images used for rebroadcasting.

Parking Garage for Yachts

Parked like cars, yachts in this big hangar rest on dollies while they await use. Most of craft in picture are 30 to 45 feet long. On about two minutes' notice, any boat can be towed by tractor to elevator and put in water. Owner may board his craft while it is still in hangar, or phone ahead and have it waiting for him afloat when he arrives.

Dry-land moorings in hangar keep craft safe from the elements but ready for use on minutes' notice.

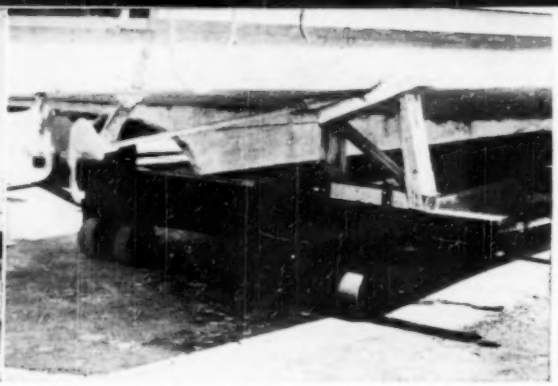
A DRY-LAND garage parks yachts like motor cars in the heart of Miami. When an owner wants his boat, the garage puts it in the water. On his return, it takes it out again.

Even 50- and 60-footers are easily whisked in and out of their natural element by a vertical elevator of the Merrill-Stevens "marina" or yachting center at Dinner Key on Biscayne Bay. A huge hangar once used

Yachting party has disembarked from 35-footer below, and handlers center it over submerged dolly on platform of vertical elevator, which has lifting capacity of more than 100 tons.

Rising elevator lifts boat on dolly. It pauses midway, while handlers check position of padded side chocks and ram them home. They serve to steady craft. Weight rests on keel.

Yacht reaches top of ride. Elevator can accommodate boat twice as long. Army-surplus power winch, designed to refloat grounded landing craft, raises platform by cables at corners.



Close-up view shows how boat rests on steel dolly, braced by sliding chocks. This end of dolly has wheels. Other end has stumpy legs, lifted from ground when tractor tows dolly.

by transocean seaplanes houses the craft ashore.

Yachts moored at docks take a beating in the Florida climate. Warm salt water and hot sun work havoc with paint and varnish. Every three months, bottoms need repainting with anti-fouling paint to discourage barnacles and grass.

Land-parked yachts, in contrast, are safe from sun and salt. A glossy racing enamel can be used on a bottom, adding up to five m.p.h. to speed. And hurricane warnings needn't worry a man whose boat is indoors!

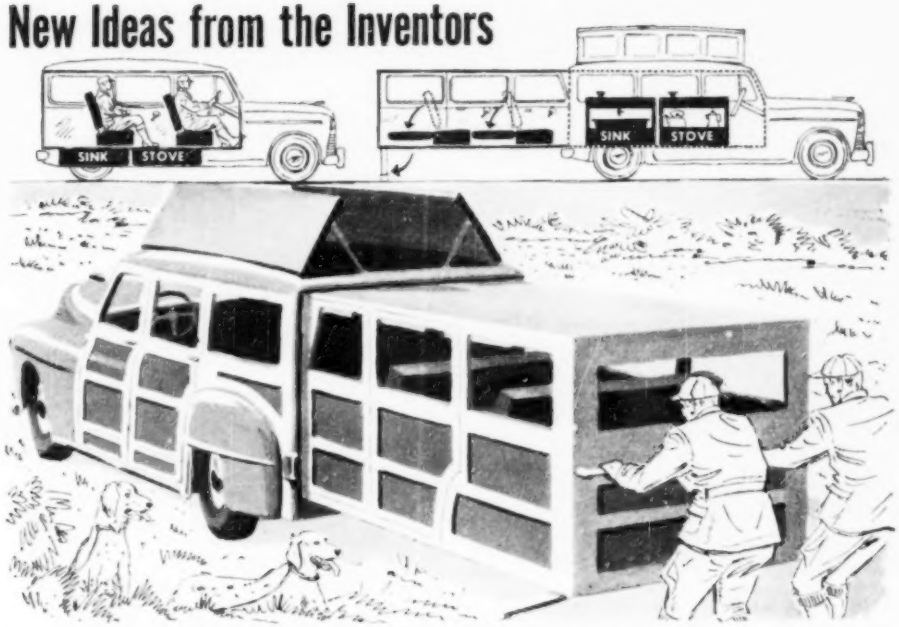
An owner doesn't have to bother with docking, bailing, and handling lines at the end of a day's trip. He turns over his boat to the handlers and forgets it. He can run his own boat, and still keep his hands and clothes clean. More than 100 craft of all sizes are floated and landed at the yacht garage on a busy Sunday, far more than could be handled by a conventional "marine railway," or inclined track.

Each yacht has its own "parking" dolly, a form-fitting cradle on wheels. A tractor trundles it on this dolly to the elevator platform, which then descends until the craft is afloat. The reverse operation lands the boat. After a yacht pulls into the landing slip and cuts its engines, an average time of two minutes suffices to park it in the hangar.

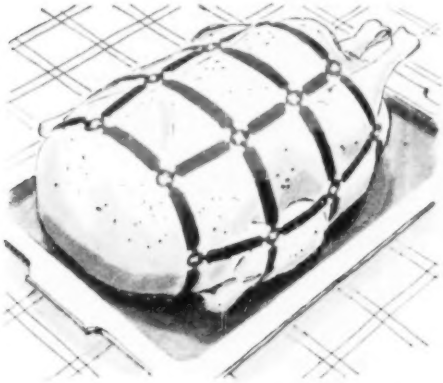
You can't park your car in a commercial garage much faster than that. END

Yacht comes ashore as tractor picks up end of dolly with hydraulic lift, and tows craft from elevator to hangar, across concrete ramp built for ocean planes and able to withstand great weight. On way, fresh-water rinse with hose washes salt off hull. Dry-land storage is said to make paint and varnish last long time. Once-a-year painting keeps many craft looking like new.

New Ideas from the Inventors



1 Camp Car to Telescope. By pulling out an inner body, this car can be converted into sleeping quarters and kitchen. The seats fold down to form a bed, while a collapsible stove and sink stowed in the floor provide cooking facilities. Roof hatches give kitchen headroom in fair weather. In the closed, driving position, corresponding side doors on inner and outer bodies operate as single units.

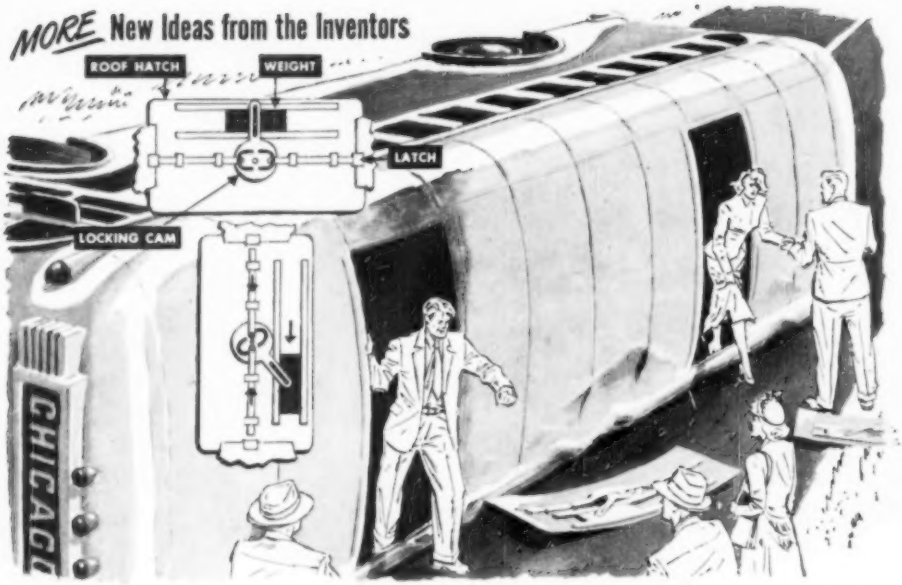


2 Harness to Hold Roasting Fowl. Fastened around a chicken or turkey by means of hooks that latch into rings, this roasting accessory holds the wings and legs close to the body of the fowl and allows the bird to be turned readily as it is cooked. The holder is made up of flexible sheet-aluminum links joined by rings.

3 Hanger to Fit on Door Hinge. Here's a coat hanger that can be put up without using screws or nails. It fits over the knuckle of a door hinge and is held in place by the hinge pin. The hinge pin is simply pulled, inserted through a hole in the top of the hanger, and driven back into place. No holes need be made in the door.

Turn the page, please, for three more new ideas.

MORE New Ideas from the Inventors



4 Hatches to Free Bus Riders. If a bus fitted with these roof escape hatches turns on its side in an accident, the hatches would pop open automatically—perhaps saving lives in case of fire or panic. A heavy weight in a cam-operated latching mechanism and gravity do the trick. When the hatch is moved to a vertical position, the weight falls and operates a cam that draws the two latch bars in to free the hatch.

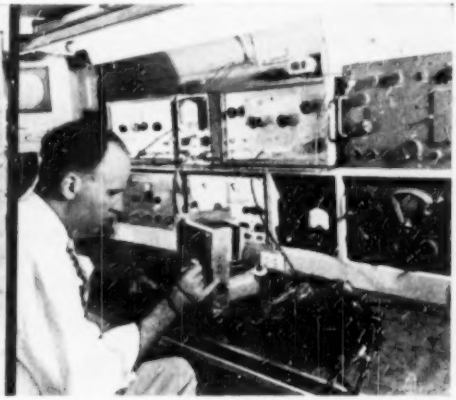
5 Fake Shrubs to Test Planting. The effect of a landscaping plan can be prechecked with these shrub silhouettes. The silhouettes, made of plywood or similar material and painted green, are fitted with magnetic fasteners that, together with magnets on the stakes, make it easy to shift or interchange the "shrubs" for effect.

6 Windows to Work Like Shades. Designed to provide a double barrier against the cold, this "storm" window is mounted on the inside and can be adjusted up and down like a window shade. Made of clear, flexible sheet plastic and mounted on a spring roller, its side and bottom edges fit in grooves to form an air seal.

Patents on these inventions have been granted to: 1. A. Carmichael, Tujunga, Calif.; 2. H. Davis, Akron; 3. A. Hunt, Lethbridge, Alberta, Can.; 4. R. Kerr, Detroit; 5. R. Metz, Farmington, Mich.; 6. E. Perems, Bayside, N. Y. and H. Wermann, Yonkers, N. Y.

Thunder Makes A-Bomb Sound

WANTED: Sound of an A-bomb. To re-create the blast for "The Quick and the Dead" radio series, NBC sound engineers started with the 16 thunder records and two specially built "rumble frames." As shown above, they were played in Radio City's Studio 8H, the world's largest, where the acoustic qualities helped the effect. Two magnetic tapes recorded the "atomic" thunder. The tapes were re-recorded a little out of time, then re-recorded again, thus combining 128 thunder records into one.



TV Shop Rides in Truck

MAYBE it looks like an ordinary delivery wagon, but this truck also advertises, sells, installs, and repairs television sets. A public address system spreads the name—and telephone number—of Electro-Crafts Television all over Kansas City, Mo. The antenna sticking through the roof can be raised 40 feet and turned in all directions to determine the correct installation for any area. And the back of this Dodge Route-Van has a complete demonstration and repair room (above, right) where even a six-footer can work without stooping. It has a TV monitor, workbench, generator, and instruments.

First job in tactical air war is to drive enemy aircraft from the sky. This keeps their fighter-bombers off the backs of our infantry, allows our planes to do their work unmolested.

Second tactical job is interdiction. That means shooting up supply and communication lines, railroads, bridges, road junctions, truck columns, to stop enemy reinforcement.

Can Our Jets Support the Guys on the Ground?

When the going gets tough, the foot-soldier wants a big, quick bang to clear the way. Can the jet deliver?

By John F. Loosbrock

DRAWINGS BY JO KOTULA

KOREA has shown that, for the GI on the ground, war hasn't changed a bit. It's still mud and cold rations, eye-popping fatigue and the whine of incoming mail. Talk with him about push-button warfare and he'll spit in your eye. He doesn't give a hoot about unification and budgets. He only wants the answer to the $64 question—"What's in it for me?"

One answer is a big, quick, murderous bang in front of him, clearing the way when the going gets tough. He first got it with crude cannon, then horse artillery, motorized artillery, tanks, and finally, airborne fire-power. Our air-tank-artillery team was the big deal in World War II.

But how does the jet fit that picture? Can it clobber those enemy tanks that are holding up the foot-sloggers? Does the Air Force fly too high and fast to help the man on the ground floor? Why, in Korea, call on the ancient and honorable (and prop-driven) North American F-51 Mustang for ground support when we've heard nothing but jets for years? To the guys on the ground, are the jets just a lot of hot air?

As an ex-doughfoot, these questions had been bothering me for a long time, even before the current fracas started. So I did a little traveling and a lot of talking—with beribboned generals and warwise sergeants—and to all ranks in between.

I flew down to Eglin Air Force Base, Fla., where the Air Force demonstrates, with live ammunition, real rockets, and very loud bombs, its ability to give close-in support—with jets.

I visited the side-by-side headquarters of Gen. Mark Clark, Chief of the Army Field Forces, and Maj. Gen. Robert M. Lee, then head of the Tactical Air Command, at Fortress Monroe and Langley AF Base, Va., respectively.

To round out the picture, I flew to the Caribbean last spring to observe Portrex,

Third job is toughest, the close-in support of infantry. With rockets, bombs, and machine guns the planes blast away at tanks and strong-points that are holding up the foot-sloggers.

Republic F-84E Thunderjet is U. S. Air Force's best ground support fighter-bomber. It can carry as many as 32 five-inch rockets (above) or varying combinations of bombs, rockets, and Napalm fire bombs. It mounts six .50-caliber machine guns in the nose for strafing missions.

the joint Army-Navy-Air Force maneuver.

And I concluded that no one knows all the answers about jets—yet. And that the hard and fast answers are going to come out of Korea and other trouble spots where the cold war may turn hot any minute.

The Air Force still figures it has essentially the same three jobs it had in World War II, in support of ground troops. First is gaining air superiority, knocking the enemy out of the sky. Then our own planes can fly safely and our own infantry isn't getting beat up by the enemy air force.

The second task used to be called "isolating the battlefield." Now they call it "interdiction." That means hitting communications and supply lines—shooting up truck columns and trains, bombing road junctions and bridges, areas where troops concentrate.

The third phase is the one that really

Ground crewmen load the rocket mounts of the F-84E with 5-inch HVARs (high velocity aerial rockets). Retracting mounts disappear into wings after firing, eliminating drag of old-style fixed mounts, enabling pilot to get maximum speed and maneuverability for combat.

interests the doughboy—bona fide close support—hitting tanks, strongpoints, anything the artillery either can't reach or knock out.

To do these jobs the Air Force stands by the jet. They figure a tactical airplane must be able to do three things:

1) Stay alive in the air;
2) Hit with bombs, bullets, and rockets;
3) Have the range to reach and fight over the target.

Take the first consideration. If you're going to be shot down by an enemy fighter almost before you get your landing gear up, you're not doing the doughboy any good. Look at what happened to the Luftwaffe. The lumbering Stukas did a tremendous job for the German army until they ran into first-class fighter opposition. Then they fell like ducks on the first day of the season.

It's almost mathematical: the conventional fighter is to the Stuka as the jet is to the conventional fighter. And, since your airplane is just an extension of your gun platform, your first job is to get where you need to go with it—and back.

We could use the conventional F-51 and the Douglas A-26 Invader in Korea when the Reds had no jets in the air. But with jet opposition the safest place for the prop-driven plane is on the ground. Or so the Air Force reasons.

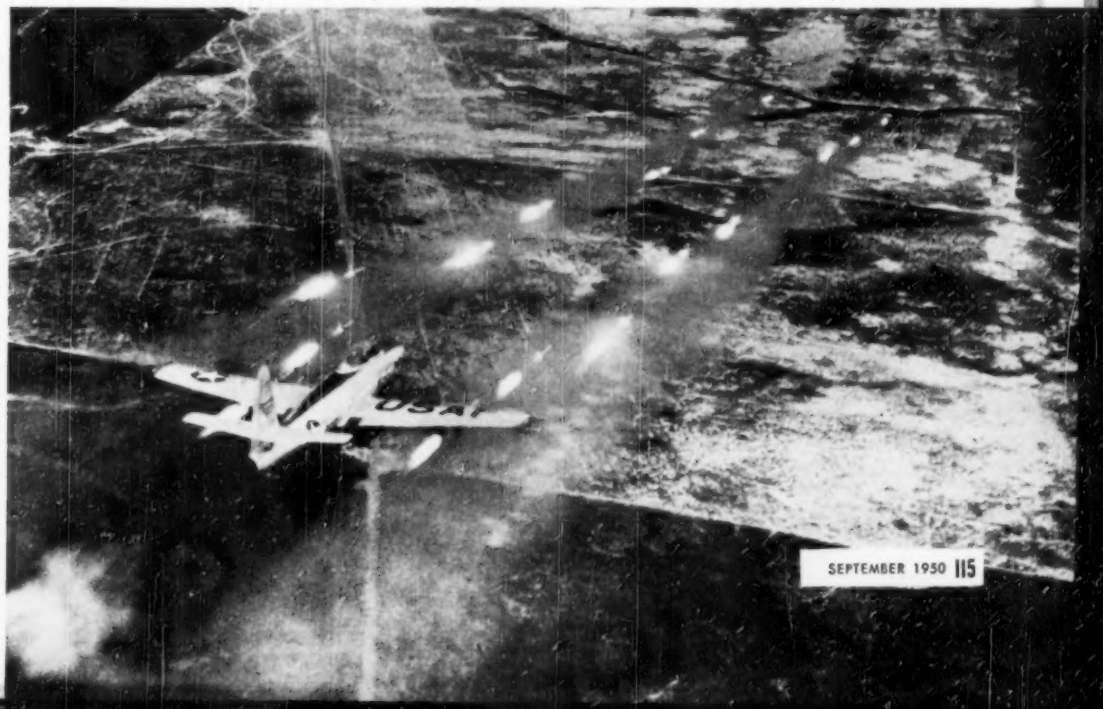
Some critics say the jet flies too fast for the pilot to spot and hit ground targets. But, says the Air Force, a jet doesn't *have* to fly fast. When it's over a target it can be throttled and flapped down to, say, 300 m.p.h. And then it compares favorably with the prop-driven plane.

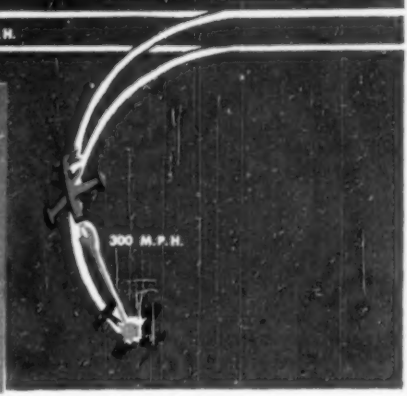
Plot it graphically. Take such items as load factors during turns, radius of turn, and rate of turn, and plot them against speed—for both types. The curves in all three categories will intersect somewhere around 300 m.p.h., indicating that, performancewise, the jet and the conventional fighter are nearly identical at that speed.

The doughboy asks two more questions. How much stuff can you throw at a target? And can you hit it? Both fair questions. Here's how the jet proponents say their equipment measures up.

It's true early jets were deficient in firepower. But from the beginning, pilots of the Lockheed F-80 Shooting Star reported it was doing a pretty fair job in Korea—even though it's so obsolete that it isn't being manufactured any more. Lack of range was its greatest drawback. But one ingenious Air Force officer in Japan already has made the F-80 a more effective weapon by designing new wing-tip tanks that raised its fighting time over the target

A salvo of rockets flames earthward as a Thunderjet dumps its load during a test run at Eglin AF Base, Fla. Plane equals in firepower eight 4-gun batteries of 105-mm. howitzers. With auxiliary wing and belly tanks, F-84E's combat radius is more than 1,000 miles.





Critics of jet in ground-support role say it's too fast, that a pilot zooming along at 600 m.p.h. or better can't spot ground targets quickly enough to do anything about them. And that at these speeds he can't hit what he sees. But Air Force says jet can be flapped and throttled down to speeds at which it can maneuver against a conventional plane. Sketches above show how maximum speeds of jet and conventional plane compare in straightaway flight, 600-plus m.p.h. versus 350 m.p.h. At their respective top speeds, the prop plane can outmaneuver a jet. But cut them both back to 300 m.p.h., as suggested at right, and the jet will compare favorably in combat maneuverability.

from 20 minutes to an hour before the pilot had to run for home.

And the F-84 Thunderjet, backbone of the Air Force's tactical air arm, not only has greater built-in range, but packs a punch that makes its wartime elder brothers look like peashooters.

It mounts six .50-caliber machine guns that spout 1,200 rounds a minute, compared with World War II's 700-800. It can tote up to 32 five-inch HVARs (high velocity aerial rockets) in lightweight, flush-type, retractable racks. That firepower equals a salvo from eight four-gun batteries of 105-mm. howitzers. Or it can carry eight five-inchers plus two Tiny Tims (11-inch rockets). Eleven inches is getting up in the naval gun class. And once the load is dumped, it's up in the 600 m.p.h.-plus class as a fighter.

When it comes to hitting a target with all this stuff the jet is good. It has no torque, so pilots like its steady gun platform. And electronic improvements may lead to sights that do everything but fly the plane. And maybe even that. Bombs have been redesigned to get better ballistic behavior at high speeds.

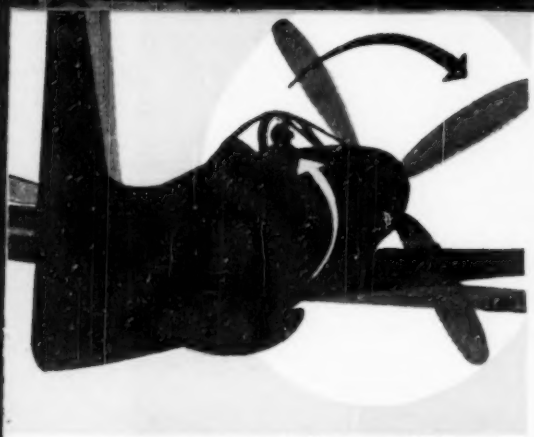
Some say jets are vulnerable to ground fire. Air Force experts say no, and point to heavier spars and members that help withstand battle damage. The jet's bigger fuel load introduced a fire hazard that has been taken care of with a technique called "purging." That's a system of pumping an inert gas into fuel tanks as they empty. The jet-engine compressor is extremely vulnerable to gunfire, but it takes up relatively little space and can be protected with armor.

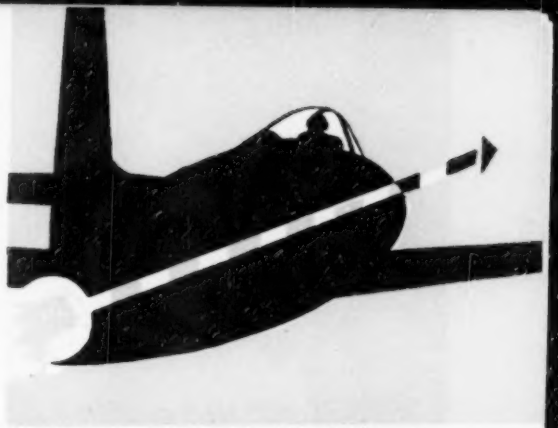
Against these advantages you have to balance the jet's inherent drawbacks. At the low altitudes necessary for tactical operations they gulp fuel voraciously. Better engines and improved fuels, however, are easing the fuel-consumption problem a little. But it's still a headache.

Long take-off and landing rolls are a serious problem, especially when operating from hastily built strips. The Navy licked the landing puzzle on its carriers with catapults and arresting gear. Maybe some-

Transparent plotting board in Tactical Air Direction Center keeps track of planes in air. Airmen plotting data write backwards so control officer in front of board can read it.

Shown below is an Air Force ground control party, directing fighter-bombers onto infantry targets. Parties work closely with infantry, sometimes spot targets from small liaison planes.





Pilots say jet is steadier gun platform than prop-driven plane. Sketches show why. Propeller torque twists plane to right. Jet has no prop, hence no torque to be compensated for.

thing similar can be worked out for land-based operations. The British have even tried landing wheels-up on sponge-rubber pads. And RATO (rocket-assisted take-off) will be used freely in wartime, when expense is no object.

Another tough nut is the business of target designation—whether you fly a jet or a conventional plane. You can't hit your target until you find it. And a doughfoot can't just stand up and point at the tank he wants you to clobber.

Visual methods, like marking the target with smoke, or setting up a bomb line beyond which you didn't dare release your bombs, worked only fairly well. The best system seems to be that followed by the Marines, pioneers in close ground support. They put control parties on the ground who talk the pilots right onto their targets. The fact that Marine pilots and ground officers have the same basic ground training help this system work well. The Air Force, too, has ground control parties equipped with radio, who spot both from the ground and from light liaison planes.

IFF for Foxholes?

Electronic gadgets that would allow blind bombing of front-line targets without hitting your own troops are another future answer. The ideal solution would be an extension of the IFF (Identification Friend or Foe) that planes used during the war.

That's about it, pro and con. We still don't know, for sure, whether the jet is the answer to close aerial support for infantry. Korea can't be used as a true test for several reasons. When the fighting started, we had no fighter strips in South Korea, so jets had to operate from Japan, 200 miles away. This has been described as expecting Jackie Robinson to cover second base from the Brooklyn dugout.

Ground to air communications in Korea were meager in the early days. Pilots had to hunt for targets of opportunity, with not much time to do it after the long flight from Japan.

And, unfortunately, the F-84Es weren't available when war broke out in Korea. They were grounded with engine-bearing trouble. And although they're back in service now, we didn't get a chance to give our best ground-support jet a workout when it was needed most.

And until we do, we're not going to know exactly where we stand on this question of the jet and ground support. Maybe the jet alone is the answer. Maybe we'll have to go back to the conventional plane. But you can bank on one thing. If jets can't do the job for the infantry, they'll be replaced by something that will. END

North American B-45 Tornado is the Air Force's high-speed operational mainstay in the light bombardment field. Here it almost leaps off the ground in a rocket-assisted take-off.

"Just like Mother made," says happy customer at Joe Gregor's Avon Park, Fla., bakery shop. Brown 'n Serve rolls look white and pasty when purchased, but turn golden brown in 7 minutes.

Rolls You Buy, Then Bake

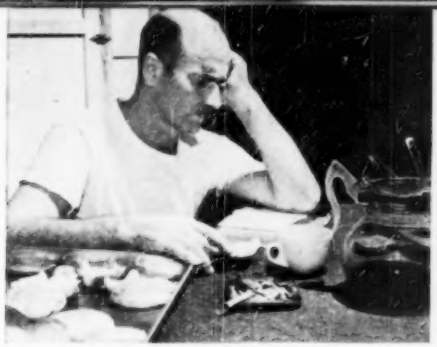
JOE GREGOR, bakery owner down in Avon Park, Florida, was carefully tending a large batch of baking rolls when the town fire alarm began to wail. Joe, also a volunteer fireman, had no choice. Knowing that the half-baked rolls would be ruined, he nevertheless shut down his oven and headed on a dead run for the firehouse.

Returning later, he was about to throw out the spoiled rolls and start over again when he noticed something curious. The rolls had not fallen as he had expected.

Just for the fun of it, Joe fired up the oven again and put part of the batch back in. In a few minutes the rolls had turned a rich, golden brown. Joe took them out, tasted them, and found them the best he had ever made. There was only one problem.

How it happened: When alarm sounded, volunteer fireman Joe Gregor turned off oven, ran for truck like this, leaving the rolls to spoil.

Returning to bakery, Joe found rolls had not fallen. He put them back in oven, browned them, and discovered they were best he'd made.



Puzzled by rolls' behavior, Joe made repeated experiments, found method worked every time. Several company and university laboratories tried to learn simple secret without success.

General Mills salesman James Taggert (center) tried Joe's rolls, liked taste, and sent samples back to home office. Company promptly bought process, made tests, then gave it to industry.

Betty Crocker Kitchens ran hundreds of tests on new rolls, found they needed slightly warmer and firmer dough than ordinary rolls, lower baking heat, and slow, draft-free cooling.

Once allowed to cool, the rolls became too hard and crusty. Why not sell them unfinished, a friend suggested, and let the customers brown them in their own ovens.

That was the beginning of Joe Gregor's Brown 'n Serve rolls, destined to become nationally famous. Now, for the first time, housewives could produce truly fresh-baked rolls without the time and trouble formerly required. They browned in only seven minutes—no longer than it took to heat up ordinary rolls. Unbrowned, they stayed fresh for two weeks in a refrigerator, and indefinitely when kept in a freezer cabinet.

The idea caught on fast, and soon 26 Florida grocery stores were featuring the tasty new product. General Mills, intrigued by the process, persuaded Joe to sell the secret, then turned it over to the entire baking industry for free use by all.

Since then, the method has been applied to a fast-growing number of bakery products, including buns, breads, sweet rolls, coffee cakes, and even Danish pastry.

Here's one "half-baked" idea that really paid off. END

New British Jet Has Sweep Wings, Single Tail

A NEWCOMER to Great Britain's twin-tailed Vampire jet fighters, this new single-tail jet fighter is called the Hawker P-1081. The plane is reported to be capable of speeds in excess of 600 m.p.h. It is shown here after its arrival at London Airport for its first public exhibition. The single tail is a departure from recent British practice.

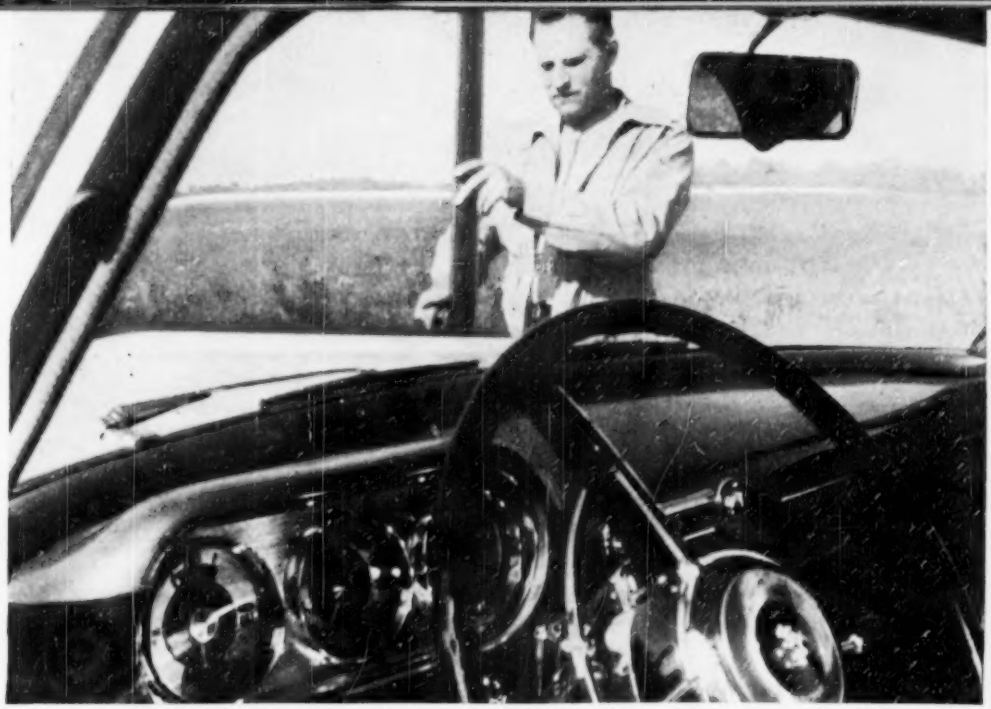
New carburetor in '51 Packard is pointed out to Wilbur Shaw by William H. Graves, vice president of engineering, at Packard Proving Ground in course of inspection of new cars. Engine has 3-point rubber suspension and hydraulic vibration damper. Blower beneath Graves' hand can provide pressurized fresh air to passengers at low car speeds during warm weather.

CLOSE-UP of the '51 Packard

By Devon Francis
PS PHOTOS BY W. W. MORRIS

THE first automobile company in the U. S. to place a straight-eight L-head engine in mass production—back in 1921—last month introduced the highest compression in the

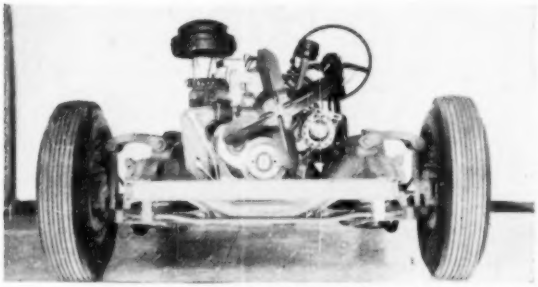
Clean, light frame of "200" model is on a wheelbase of 122 in., 2 in. greater than on 1950 model it replaces. Wheelbase of "300" and "Patrician 400" models (replacing 1950's Super and Custom) remains unchanged at 127 in. All models have almost 9 in. ground clearance.



Point of maximum fender height is marked by upright stick, showing good right-side visibility from driver's seat. Windshields have maximum width of more than 56 in. Fore-aft adjustment of front seat is 4½ in. Headroom in front is 36 in., rear 35. All body mountings float in rubber. Fuel tank on "200" has been enlarged to take 20 gals., boost of 3 over the equivalent 1950 model.

industry in standard-sized cars. The '51 Packard, as Wilbur Shaw remarks in his *Report from the Driver's Seat* in this issue (page 100), is available with a ratio of 7.8-to-1.

With a new type of automatic spark control and a leaner mixture in these new engines, Packard expects to get from two to three more miles from a gallon of gasoline at speeds between 20 and 45 m.p.h. Above that, they will deliver about a mile more to the gallon than at present.



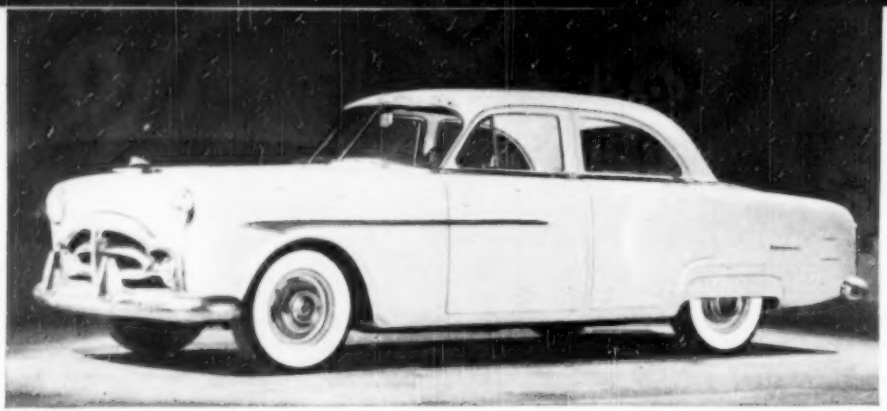
To reduce hood height to 43.8 in., water pump and fan were lowered. Lowering pump also insures cooling even when water level is low.

Packard now offers a greater choice of horsepowers without increasing the number of engine models on its production line. Here's how:

For 1950 the company offered engines of 135, 150, and 160 hp. For 1951 there are still only three basic engines, one of 288 cu. in. displacement, one of 327, and a third of 327 but with nine instead of five main bearings. The horsepowers available—135, 138, 150, and 155—spring from compression ratios ranging from 7-to-1 to 7.8-to-1. Premium fuel is a must for engines with 7.5 and 7.8 ratios.

The company has also completely re-done its models. The entire frame and body, including the side rails, roof rails and pillars, are built of box-section steel for greater rigidity, weight-saving, and safety. This is evident in the ultrathin windshield pillars.

The Ultramatic transmission (PS, June '49, p. 139) has undergone refinement. Its oil cooler, for instance, has been removed from the engine radiator and mounted below the water pump. This improves accessibility and is greater insurance against oil-line leakage. The governor in the control system has new



Classic Packard lines are retained despite restyling. This sedan is in "200" series. Rear window on this series is doubled in size. Instrument panel is recessed to prevent glare from incident light.

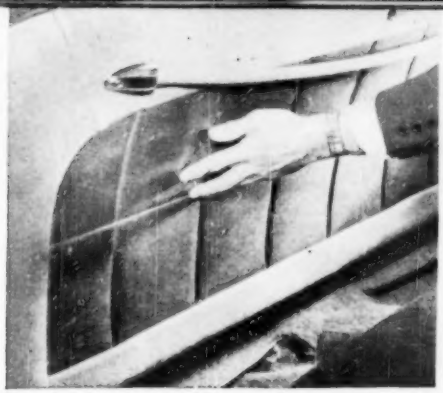
gearing, and bearings have been steel-backed to increase their life. Pistons in the control system are bigger.

The styling is brand new. You'll have to give the new Packards a double take to recognize them. Yet you get the feeling that Packard has gone back to that familiar dignity of line the car had when it was known as one of the few fine vehicles in America and one that didn't greatly change its looks from year to year.

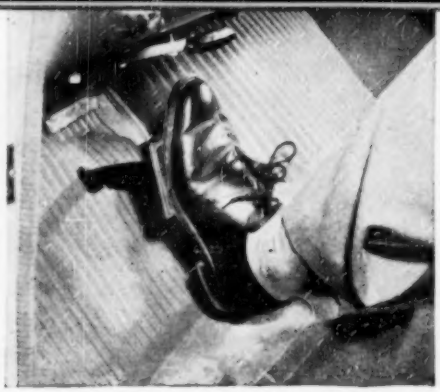
Over-all heights are reduced two inches without a sacrifice of ground clearance. Incidentally, it's without a sacrifice of headroom in getting in and out, either. In two of the models, the "300" and "Patrician 400," the area of the rear window is two and a half times as great as it was in the 1950 models. Leg room and hip room are boosted. Over-all lengths are increased—and the length is in the body, not in the hood.

Finally, the new Packards give you an extraordinary amount of visibility. I am accustomed to driving in New York traffic, and

Manufacturers gradually are realizing that American motorist, nomadic at heart, needs storage space. Packard's luggage compartment has been boosted from 19½ cubic feet to 30-plus.



Heat-sealed plastic inset paneling on rear of front seat is stain- and scuff-proof and is designed to outlast car itself. To increase softness of ride, rear springs are ½ in. wider.



By moving brake pedal to the left, designers make it available to either right or left foot. Wilbur Shaw commented, "With practice, the left foot is bound to become the braking foot."

seeing what's around me to the front, sides, and back is the first design requisite to safety. The hood line has been lowered a full 4½ inches. There's no trouble in seeing what's in front of you unless it's right under the wheels. And the windshield and window areas are as good as, if not better than, any of the new cars on the road, size considered, with the possible exception of the Studebakers with the wrap-around glass.

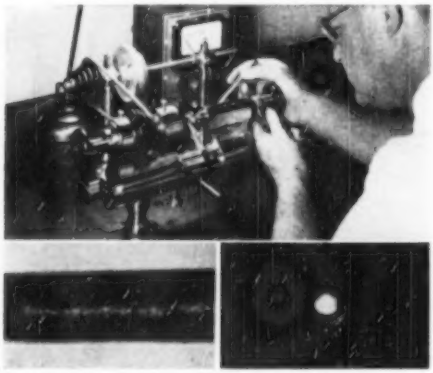
Packard for '51 has four lines of cars. The "200" comes in sedans and a business coupe. This is the smallest of the company's cars and is the one pictured with Wilbur Shaw on the cover. The "200" also comes in a de luxe version and will include a hard-top convertible after the turn of the year. Next in size is the "300," a four-door sedan. The fanciest of the lot is the "Patrician 400" sedan. END

Hood-release lever on the '51 Packard is inside grille because of breakage trouble with cable from driving compartment. It sacrifices engine-compartment theft protection, however.

Ample entryway is provided for rear-seat passengers in two-door sedans. Body paneling is Fiberglas-padded to reduce road noise. Except in "200" series, seat cushions are foam rubber.

Pick-Up Truck Fights Fires

THE town of Trenton, Mich.—population 7,000—couldn't afford a real fire engine, so it rigged up this Dodge pick-up truck to fight fires. One of four trucks now in use, it carries a pump, operated by a power take-off, that can deliver 150 gallons per minute, as well as 2½- and 1½-inch hoses and extinguishers. For brush fires, it also has a 145-gallon water tank and a 150-foot reel of ¾-inch hose. The equipment cost $800.



Navy Drills Smallest Hole

THE tiny hole at right above, magnified over 200 times, is 6/10,000 of an inch in diameter—half the size of the human hair at left. Believed to be the smallest hole ever made in metal in this country, it was drilled in a piece of platinum for use in a new Navy weapon. It was made on a jeweler's lathe (top), with an electric ohmmeter to determine when contact had been made between the metal and the delicate drill.

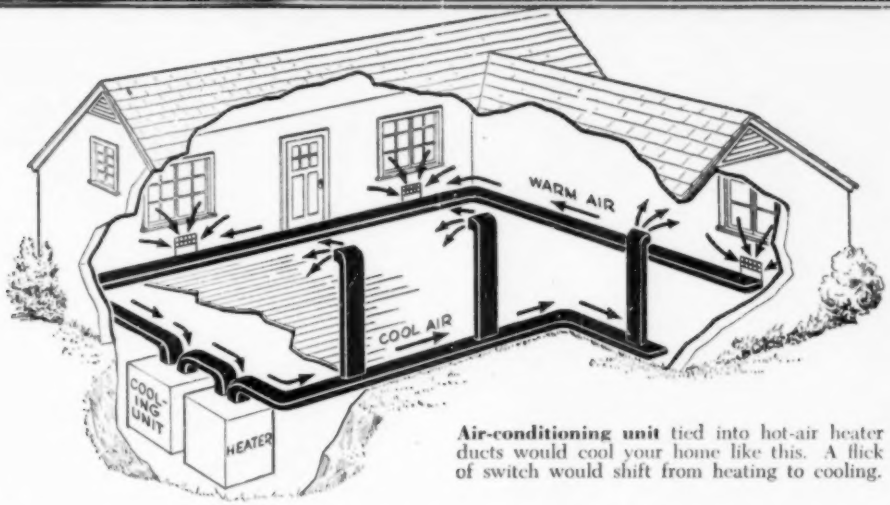
Plastic Guide Teaches Typing

BEGINNING typists can't hit wrong keys and get into bad habits with this new teaching aid. Designed to fit any standard typewriter, it consists of seven flexible-plastic partitions that divide up the keyboard so that each finger can hit only its proper group of keys. Made by Type-N-Guide, Inc., of New York City, the device is also being used to speed the teaching of blind students. It sells for $3.50.

My Most Ingenious Solution

Here's how I solved the leaf removal problem without using a rake.

I lowered the lawn mower's cutter bar enough to clear the blades. Then, with the grass catcher in place, I pushed the mower around the yard. The blades slapped the leaves into the catcher, cleaning the lawn and saving me a lot of work.—Floyd Way, Mobridge, S. D.



Air-conditioning unit tied into hot-air heater ducts would cool your home like this. A flick of switch would shift from heating to cooling.

Home Cooler Hooks to Hot-Air Ducts

YOU'RE in luck if a forced-draft hot-air system warms your home in the winter. At surprisingly moderate expense, you can adapt it for another job—cooling your home in the hot summer months.

For this, you could use an air conditioner developed by the York Corporation, of York, Pa. Existing ducts and wall or floor registers would deliver cold air, blown by the heater fan.

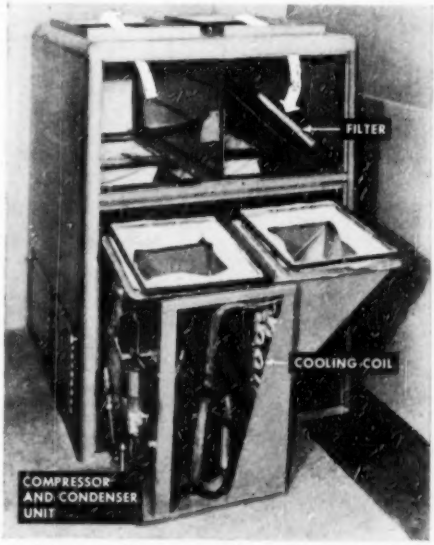
Yorkaire conditioners are made in half a dozen models. The photo at right shows a medium-sized unit. The company estimates it would cost less than $1,000 to air-condition the average five-room house, using a 2-hp. unit and existing furnace ducts. For more spacious homes, a larger unit can be used, or several small ones coupled together.

In all units, the complete refrigerating circuit—compressor, condenser, refrigerant lines, and cooling coil—is tightly sealed at the factory. In case of trouble, the entire unit would be replaced.

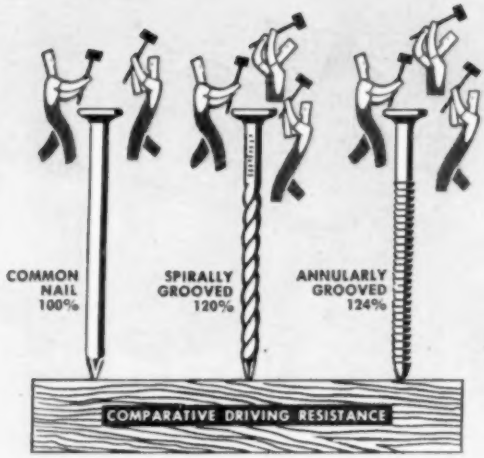
Some installations include two separate 1-hp. units. Only one would operate until the weather got very hot. A thermostat automatically controls the operation. The units are adjusted to keep room temperature 10° cooler than that outside—and the humidity at a constant 50 percent. All the basement models have water-cooled condensers. In areas such as New York that require the reuse of cooling water on large models, the condenser is easily adapted to cooling-tower application. This usually costs between $65 and $100.

Although designed for use with a hot-air heating system, the York units also can be installed as an independent system.

Operating cost naturally varies with the size of the unit, cost of power and water, and such factors as location and type of house. In one fairly large Pennsylvania house, power and water costs to operate a 2-hp. unit continuously during June, July, August and September were less than $40.



A filter in the return duct cleans air that's circulated through the house. Resembling an auto radiator, the cooling coil includes both tubes and fins for fast removal of heat.



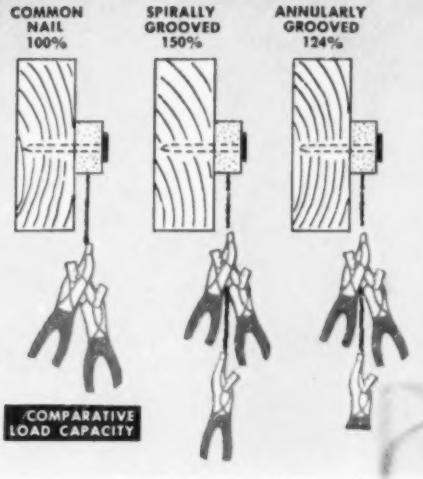
It may take more force to drive the improved

You Drive 'Em like Nails—They Hold like Screws

Whether the load's in shear or in tension, these grooved nails are more than five times better than ordinary ones.

NEW fastenings that combine the best features of both screws and nails now make it possible to build stronger wood frames for homes and similar structures. In recent tests conducted by Virginia Polytechnic Institute's Wood Research Laboratory, wood building frames assembled with one type of improved nail proved to be more than five times stronger than frames held together with ordinary smooth-shank nails.

Three special nails, which are manufactured by the Independent Nail & Packing Co., of Bridgewater, Mass., get their increased holding power from grooves in their shanks. Although they can be driven like nails, they act more like screws in that



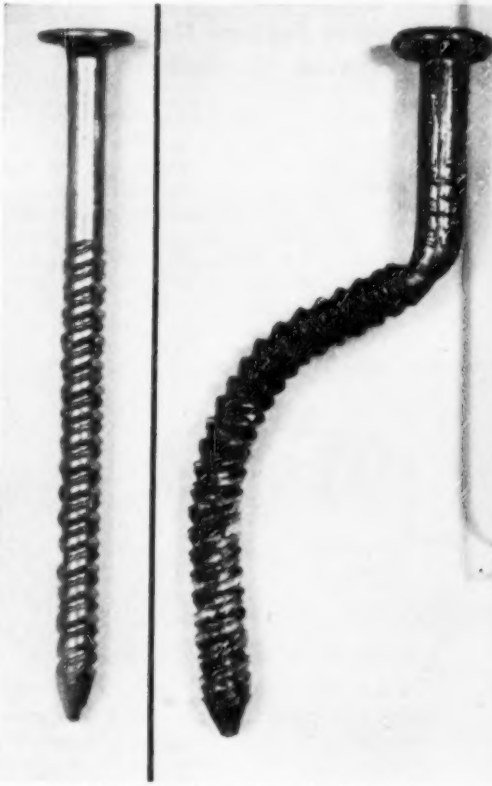
nails, but it also takes more force to pull them out or to loosen a joint fastened with them.

they have high frictional resistance to withdrawal. One nail, called the Screwtite, has helical grooves. Another, known as the Stronghold, has annular grooves. While the third, and the newest, is an improved helically grooved nail called the Stronghold Screwnail.

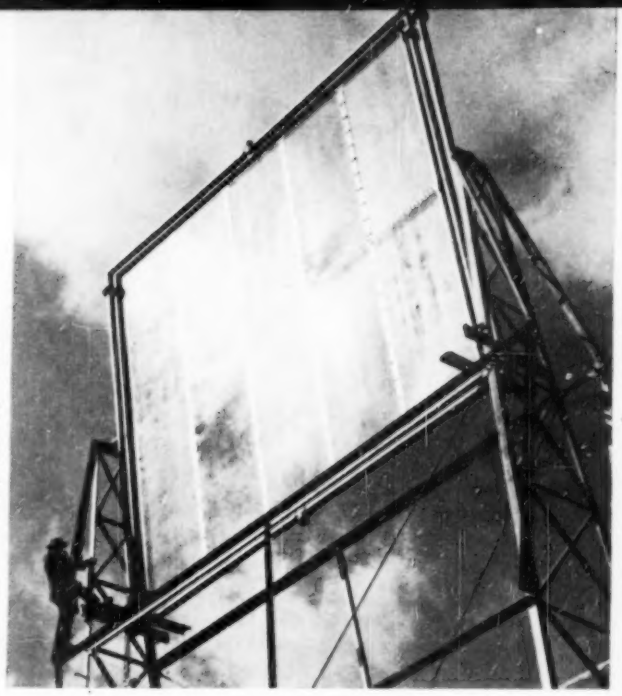
The helically grooved nails, with a long pitch to the groove, turn as they are driven. The grooves actually form threads in the wood by displacing and compressing the wood fibers. As a result, the wood grips the nail so tightly that when it is forcibly withdrawn, its shank often will be twisted in the reverse direction. Since the head is held by the withdrawing claws, it's the plain shank that takes on the reverse twist.

When an annularly grooved nail is driven into wood, the fibers are forced over the rings and into the grooves to form a series of interlocking wedges. They hold the nail so well that it requires seven times more force to pull an annularly grooved nail than it does to pull a conventional smooth-shank nail. It was this type of nail that was used to put together wood building frames in the laboratory tests.

The helically grooved Stronghold Screwnail combines the wedging feature of the annularly grooved nail and the design of the helically grooved nail. These nails, according to Dr. E. George Stern, in charge of the VPI research, provide maximum resistance to tension, buckling, bending, and shearing during driving and while they are in service. END



Stronghold Screwnail combines the best features of the helically grooved nail and the annularly grooved nail. Heavy lateral load bent this test nail, but didn't shear it off.



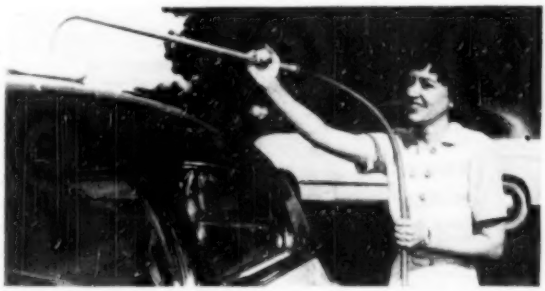
Radio Beam Bounced Around Mountains

A 20-FOOT-SQUARE aluminum "mirror" has solved the problem of communication between a Seward, Pa., generating plant and a substation about 12 miles away.

Difficulties of installing and maintaining a telephone line in this mountainous region favored a microwave radio link. But microwaves travel in straight lines, and won't go through mountains. After weeks of searching, Westinghouse and Pennsylvania Electric Company engineers found a mountain top in sight from both generating plant and substation. On a tower here they set up a reflector (photo at right above) made of sheet aluminum, perforated to reduce wind strain. It bounces a radio beam around the mountains, as shown on the map, and permits two-way microwave conversations.

'Copter Alights on Skids

SKIDS of steel pipe, replacing landing wheels, enable this new Bell 47D-1 commercial helicopter to alight on snow, ice, and rough or soggy ground. Landings have been made at up to 40 m.p.h. on ploughed fields. Two small wheels above the skids may be cranked down to aid in moving the craft on the ground or in a hangar.

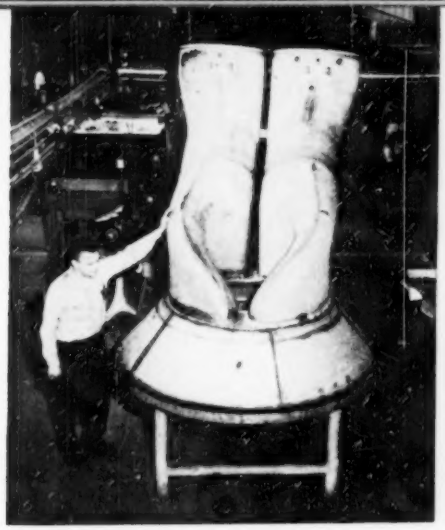


Mop Is Handy Car Washer

A LAMB'S-WOOL head is attached to the washing end of this L-shaped pipe, and a garden hose to the other. Water flows through holes in the six-inch bonnet, preventing the accumulation of dirt on the wool as it cleans. A 36-inch handle makes it easy to reach all parts of the car. The washer is made by Babcock and Co., Oakland, Calif.

Transport Leaps into Air

BOOSTED into the air by six Jato rocket units, as above, the Air Force's new 40,000-pound Northrop Raider takes off after a run of only 500 feet, enabling it to operate from small fields and unimproved clearings. The three-engined C-125 serves as a light assault and Arctic rescue transport.



"Sculpture" Is Tailpipe

RESEMBLING a bizarre piece of sculpture, this is the largest tailpipe ever built. Its twin stainless-steel ducts carry away exhaust gases from the giant Wright T-35 Typhoon turboprop engine. Driving a propeller, the power plant has been test-flown as a fifth engine in the nose of a B-17 bomber.

Speeds Messages by Cable

AN OLD-STYLE ocean cable will carry at least twice as many words a minute when this vacuum-tube amplifier is spliced into it and lowered to the bottom, 200 miles offshore. Thus Western Union plans to modernize seven of its 10 transatlantic cables. The rest are newer high-speed ones.

Warships Get New Masts

REPLACING single heavy "sticks" of steel, new-type tripod masts of lightweight aluminum are being installed on U. S. picket destroyers, as above, to carry radar equipment. Paring unnecessary weight on a warship means more available for armament, armor, and power plant, where it counts.

With exhaust streaming from "snorter" (left), Army's new 2½-ton truck undergoes water test with sealed engine submerged. Engine has 331 cu. in. displacement and compression ratio of 6.73-to-1 for operation on 80-octane gas. Six cylinders develop 145 hp. at 3,400 r.p.m. Bore and stroke are the same—4⅛ in. Engine block has cylinder sleeves of wet type.

New Army Truck Runs Under Water

Deflection of axles shows ability of new truck to travel crosscountry. Drive is straight-through type with one shaft to rear, other to front. Two-speed transfer case has constant-mesh gearing and synchronized shift for both speeds. Design incorporates a power take-off.

Power to all six wheels enables truck to climb out of mud holes like this. One big advantage of design is reduced number of differing parts. Frame crossmembers, for instance, are all the same. Seven main engine bearings are interchangeable, as are the connecting-rod bearings. Rear axles are duplicates, along with such items as drive assemblies, wheel-bearing cones.

Not only that, the "Eager Beaver" can also lug a 100-percent overload at 60 m.p.h., run at 65° below or 125° above.

THE U. S. Army has a new addition to the backbone of its motor-transport fleet—the 2½-ton truck. This job can ford a stream or climb through surf in a landing operation with its engine completely submerged. It can leave the highway and go gallivanting off cross-country with engine power driving all of its six wheels. It can run in subzero cold or desert heat.

Tested at Aberdeen Proving Ground in Maryland and at other Army bases, the new truck is being built by the thousands by Reo Motors, Inc., of Lansing, Mich. The design was developed by U. S. Army Ordnance.

The most spectacular feature of the "Eager Beaver," as the truck is known, is its ability to operate in water. Completely waterproofed, the engine needs only two extension pipes, one for the air intake and the other for the exhaust. The first is called the "snorkel"—named for the German submarine breather tube—and the second the "snorter." With the tips of these out of water, the truck driver has only to keep his head above the surface.

The Eager Beaver can be produced with a variety of power transfers to the wheels. The engine can deliver power to all six wheels or to the four rear wheels; and when the vehicle is built as a four-wheeled truck, to all four wheels or to the two rear wheels.

Combined with this is a new type of transfer case for automatic engagement of the front-axle drive. A double overrunning clutch, operating off a reduction gear, drives the front-axle shaft at a lower speed than that of the rear shaft. Positive drive to the front axle does not take effect unless the rear wheels slip or until enough windup occurs in the rest of the running gear to absorb the difference in output shafts.

Here are other things the Eager Beaver can do:

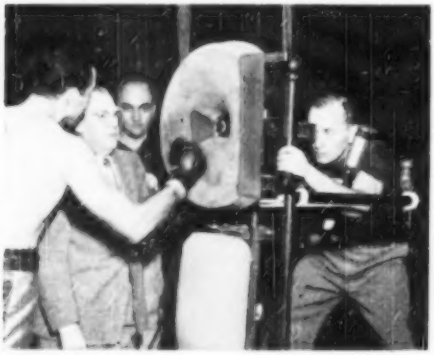
- Carry a 5-ton payload on a highway at 60 m.p.h.
- Take the same load up a 60-percent grade.
- Maintain 30 m.p.h. on a constant grade of 5.8 percent.
- Cruise 340 miles at 35 m.p.h. without refueling.
- Tote a 2½-ton payload across open fields.
- Undergo extensive repair at emergency depots—thanks to high interchangeability of parts. END

Spot Welder Resembles Gun

THIS triggerman isn't shooting Martian invaders with a Buck Rogers weapon. He's simply using a specially designed, portable welding gun to spot weld jet-engine cone assemblies at the San Diego, Calif., plant of the Ryan Aeronautical Co. Suspended from an overhead carrier, the trigger-controlled welder has hollow brass electrodes two inches in diameter and 22½ inches long. These welding electrodes are adjustable to straddle both sides of the cones and to reach into hidden interiors.

Gauge Measures High Vacuum

RESEMBLING large radio tubes, the supersensitive electronic pressure gauges above can detect air in a vacuum where only one air molecule remains out of every 10,000 billion originally present. Sealed to a vacuum system, the glowing filaments shoot off electrons that knock off part of any air molecules they hit, creating positively charged ions. The number of ions formed per second, read on a meter, is an accurate measure of pressure. The gauge was developed by Robert T. Bayard, of Westinghouse.



Padded Camera Takes Punches

FOR getting realistic effects in fight pictures, John Arnold, MGM's camera head, cooked up this camera punching bag. Heavy sponge rubber mounted on a framework surrounds the camera eye. Padding below is for body blows. When a punch lands, framework jars camera—producing pictures as they might appear to man being hit.

Car Rack Has Telescoping Rod

THIS automobile garment rack has a sliding rod that allows the car doors to be opened without disturbing the clothing. Weighing less than one pound, the aluminum-alloy rack hangs on rear-door window supports. Rubber disks prevent hangers from sliding and obstructing rear vision. J. G. Frederick, Los Angeles, sells it for $3.75.

Two-minute conversion turns car into ambulance. Inventor, at wheel, gets instructions over radio telephone. Note oxygen tank near dash. At left, roof spotlight and whip antenna are only hint of car's double purpose.

You Can Convert Your Car to a "Quickie" Ambulance for $25

By Sheldon M. Gallager

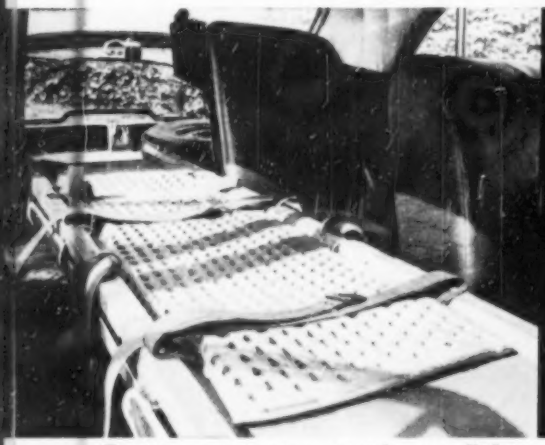
ONE cold winter day nearly three years ago, young college student Pete Stern was skiing in the hills around Syracuse, N. Y., when he fell and was badly injured. Hours later, exhausted and near freezing, he was picked up by the Ski Patrol and carried into town in the back of a pickup truck.

As the result of that experience, Pete did two things. He joined the Ski Patrol, and he got an idea. A truck, at best, is no substitute for an ambulance. There must be a way, he thought, of converting an ordinary automobile quickly, simply, and cheaply into an emergency ambulance for use in such rescue work, particularly in areas where regular ambulances are not available and hospitals are miles away.

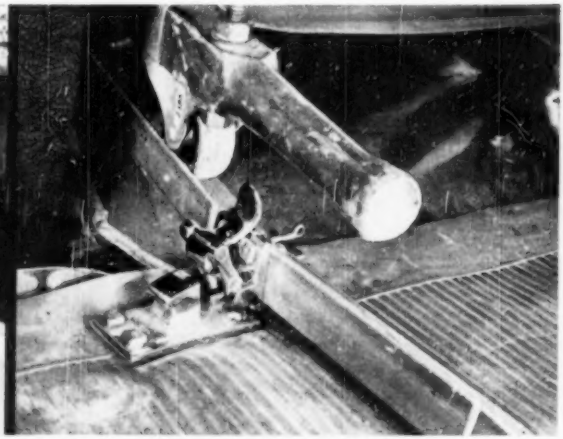
Pete went to work. He bought a collapsible Army stretcher and some angle stock for use as rails to support the stretcher inside the car. Then he sawed out the composition-board partition between the trunk

1 Before conversion, car looks like any ordinary pleasure sedan. Light on inside of left front door, inventor's own idea, goes on when door is opened to warn cars coming from behind.

2 Notched bolt holes on hinge arms of right front seat allow back to lift out without unbolting. On two-door cars, extra expense of divided front seat would not be necessary.



5 With rails in place, stretcher is rolled in through trunk until it nearly touches dash. A discarded jeep hood latch, bolted to one rail, hooks into stretcher, locking it to rails.



6 Rails are locked quickly in place by two old refrigerator-door catches bolted to trunk floor. Stretcher's legs were replaced with small wheels to lower height, let it roll smoothly.

and the rear seat in his 1949 Chevrolet, fastened down the rails, and rolled in the stretcher.

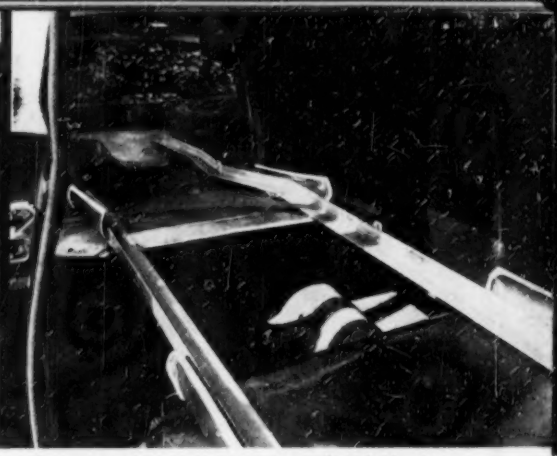
It worked, but it wasn't good. The stretcher extended only to the back of the front seat, and its rear end hung precariously out of the trunk. Then Pete hit on an idea. He replaced the one-piece front seat with the divided type, removed the right-hand seat back, and ran the rails up to the dash. That let the whole stretcher in.

Now that Pete had the arrangement he wanted, the next job was to see how fast it could be set up. He timed it. It took two minutes—maybe less, if you hurried. And nothing had been done to the car to mar its appearance or lower its resale value.

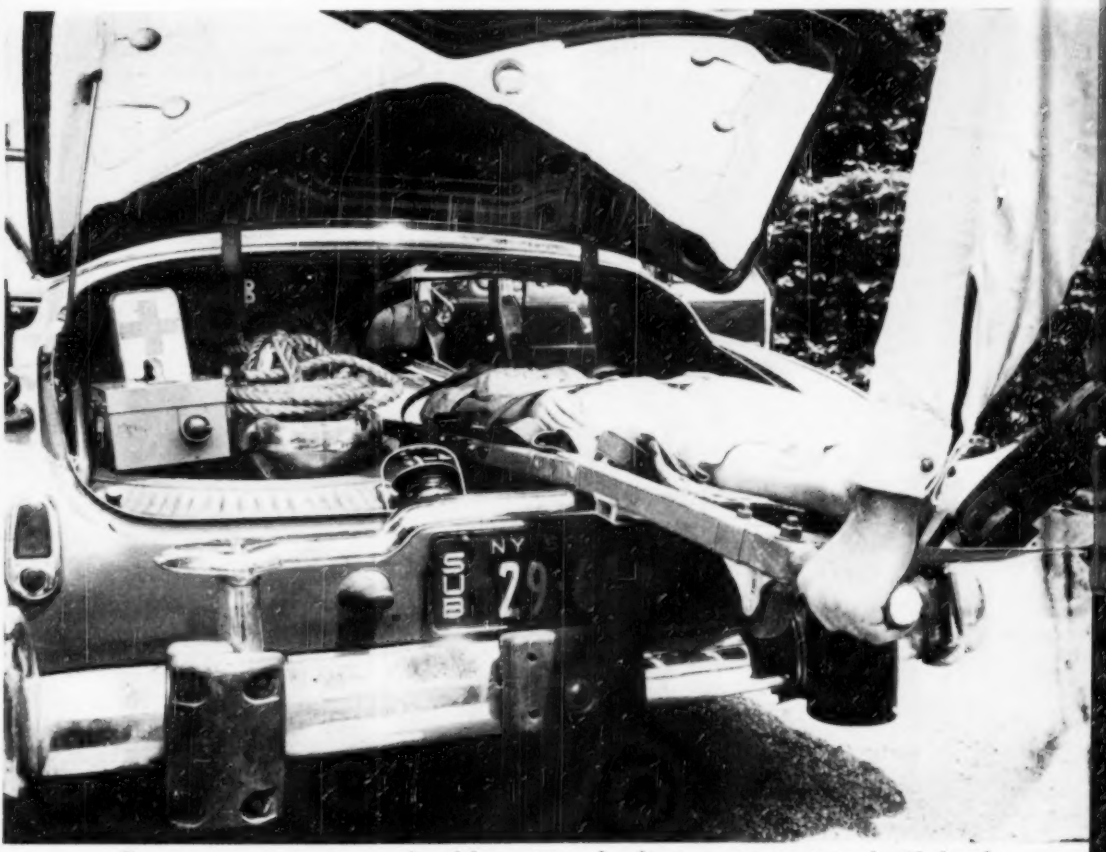
In the two years since then, working with the Ski Patrol in Syracuse, Pete and his home-made ambulance have helped in half a dozen ski rescues and a dozen highway accidents. Now a Red Cross instructor and student of industrial design at the University, he hopes his creation will inspire others.

Pete figures he spent about $7 for the stretcher, bought war-surplus, $10 for the extra front seat, picked up at a junk yard, $5 for the rails, and a few bucks for hardware. That's less than $25—not much for something that may help save a life.

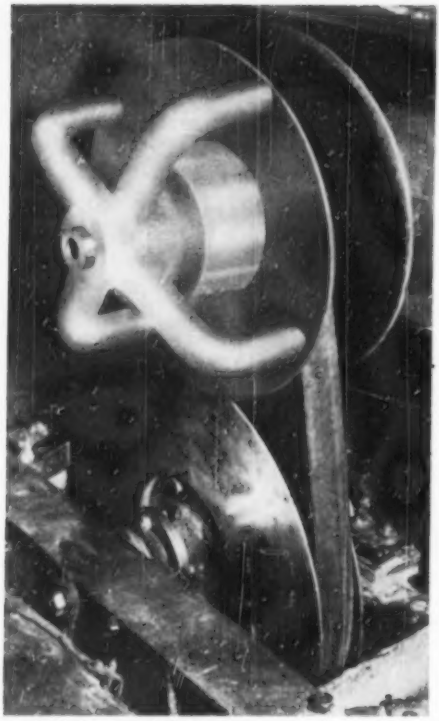
3 **Back of rear seat** is removed to make passageway through to trunk. Then back of right front seat is removed and turned on its side to make a backrest for the left side of the rear seat.



4 **Rails are 10 feet long,** hinged at high point of rear seat and low point between trunk and rear seat. Sheet-metal pans, turned up at edges, protect upholstery, keep rails from spreading.



7 **Conversion completed,** stretcher slides easily into car through trunk. Note surprising amount of clearance. Folded, both stretcher and rails store crosswise in trunk. Black-and-white pattern painted on inside of trunk lid increases car's visibility from the rear.



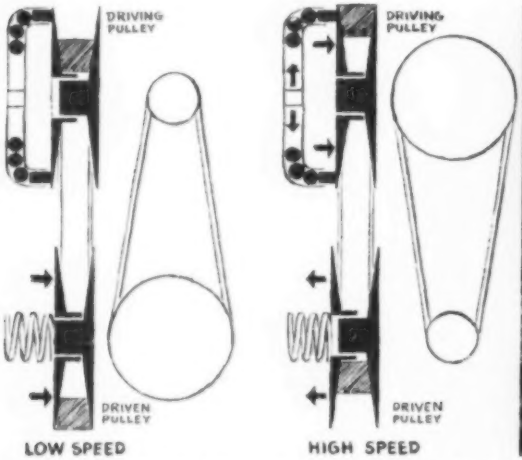
Steel balls are held in four curved tubes that spin with shaft. As speed increases, centrifugal force throws balls against pulley, pushing halves together, and belt rides up toward rim.

Clutch Pulley Shifts by Itself

THIS new automatic clutch pulley does for belt-driven machinery what automatic transmissions do for cars. It provides an infinite number of gear ratios and automatically selects the right one for any load.

The V-shaped driving pulley is split, and its outer half is free to move sideways. Fitted against this half are tubes containing steel balls. As the pulley speed increases, the centrifugal force of the balls squeezes the halves together, forcing the V belt to ride up. The belt's other end then rides down on the driven pulley, also split, whose halves are held together by a spring (see diagram). When a load slows the motor, decreased centrifugal force lets the belt ride down on the driving pulley and up on the driven one, automatically changing the ratio.

When the pulley is fully opened, the belt is disengaged and rides freely on a ball-bearing collar. This eliminates belt wear during idling and permits the pulley to pick up heavy loads gradually. By varying the size, weight, and number of balls, the pulley can be made to produce any desired rate of acceleration. The Driv-Way Lite Co., of Denver, Colo., makes the 7½-inch pulley.



Drawings above show how centrifugal action of balls automatically changes belt from low-speed, high-torque ratio (left) to high-speed, low-torque ratio (right) as motor speed increases.

Installed on motor scooter, clutch pulley becomes automatic transmission, constantly varying gear ratios to meet changing road loads. It also makes possible smooth starts and stops.

Tabs Take Over Helicopter Pilot's Big Job

KEEPING a helicopter stable—overcoming its tendency to sway, roll, and pitch—is the pilot's most tiring job. But he may soon get relief during long cross-country and night flights from a new stabilizing device that makes automatic control corrections when gusts or turbulent air begin to toss the fuselage about.

The main external elements of the stabilizer are shown in the photos above, installed on an HRP-1 Piasecki tandem helicopter. Tabs located under the nose, indicated by arrow in photo at right, are connected to the craft's lateral controls. When the fuselage begins to sway and roll, air flowing across the tab surfaces moves them. This movement is automatically transmitted as a control correction on the stick, reducing roll and yaw without any pilot action.

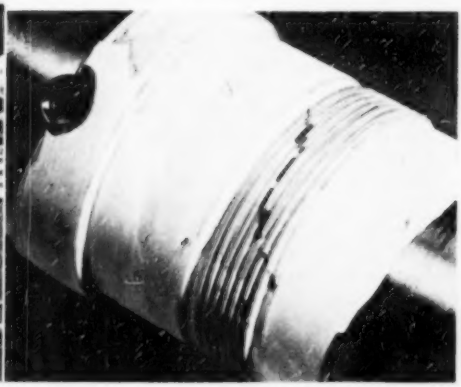
Similarly, tabs indicated by arrow in photo at left are connected to the 'copter's longitudinal controls. When air disturbances cause the fuselage to pitch, movement of these tabs reduces nose-down or nose-up movement.

The device was developed by Commander Frank A. Erickson, U. S. Coast Guard, in conjunction with Piasecki Helicopter Corp.

Simple Dye Test Shows Up Cracks in Metal Parts

JUST by brushing a couple of chemicals over a metal part, mechanics can now find tiny cracks that might mean future trouble. Even microscopically small defects are quickly spotted as Dy-Chek solutions outline them in bright red.

Originated for airplane gas turbines, the new crack-finding method is earning wide use among automobile repairmen. The first step is painting the cleaned metal piece with a bright red dye. After five or six minutes, this is washed off. Then a "developer" is brushed on (below, left). This quickly dries, leaving a coat of fine, white solid particles. Capillary action draws up any dye remaining in a crack, making a red stain (below, right). Dy-Chek Co., Hawthorne, Calif., makes the chemicals.



Rebuilding The White House Inside Out

WHEN the ceiling in the sumptuous Blue Room of the Executive Mansion began heaving ominously over the important heads gathered there at a Presidential reception in 1948, that did it. The White House had long been known to need repairs, but until then nothing had been done.

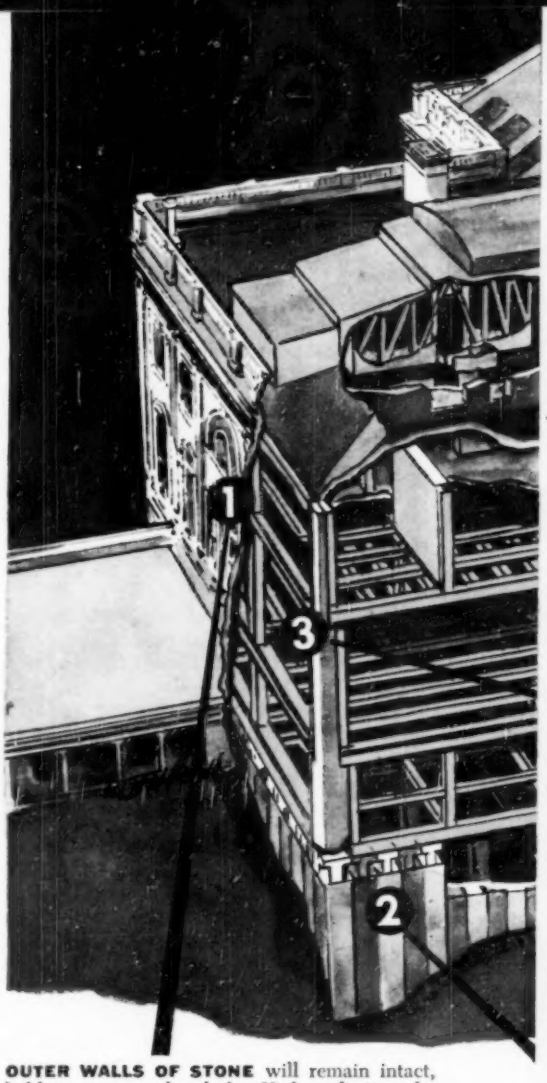
The President moved hastily out, and engineers moved in. They found once-sturdy wooden beams, weakened by age and repeated borings for pipes and wires, slowly giving away. The floors were sagging, the masonry was crumbling to dust, and the inner walls of brick, having no footings, were sinking. The White House was a wreck and a firetrap, on the verge of collapse, and no simple patchwork would fix it.

To save the structure, the engineers promptly went to work on a two-year, $5,400,000 job of completely rebuilding it from the inside out, preserving only the roof and outer stone walls, found still intact. They put down 120 new concrete piers to support the outer walls, then started on the slow task of replacing the weary wooden timbers, one at a time, with steel girders.

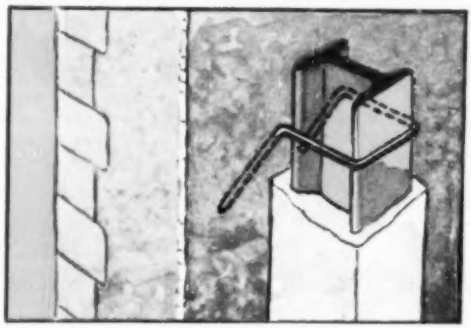
When this is complete, the crumbling brickwork will be removed, new walls and floors of reinforced concrete will be put in, and the building's entire insides will be a single, solid framework of steel and concrete. Then decorators will move in to re-create the former appearance, using as much of the original trim, woodwork, and fixtures as possible.

When the job is completed in the fall of 1951, the President will move into a brand-new White House behind the familiar face of the old one—and this time there'll be no danger of its falling in on him.

THREE MAIN STEPS in White House reconstruction are shown in drawings at right, reprinted by permission of *Steelways* magazine, published by the American Iron and Steel Institute.

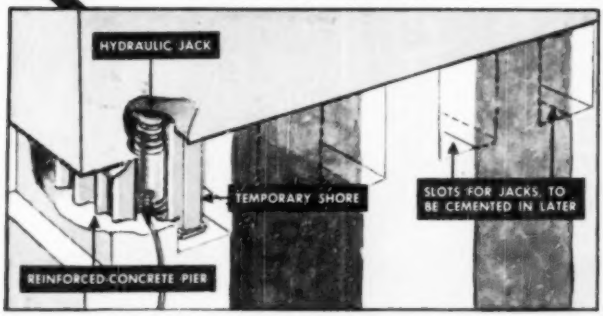


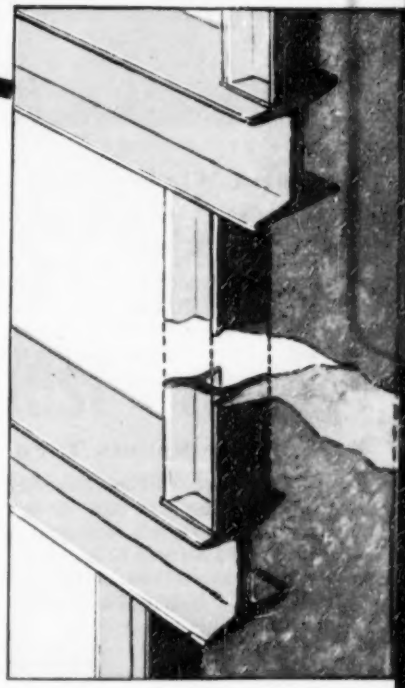
OUTER WALLS OF STONE will remain intact, held to new steelwork by U-shaped tie rods. Shaky inner brickwork will be replaced with new walls of reinforced concrete.

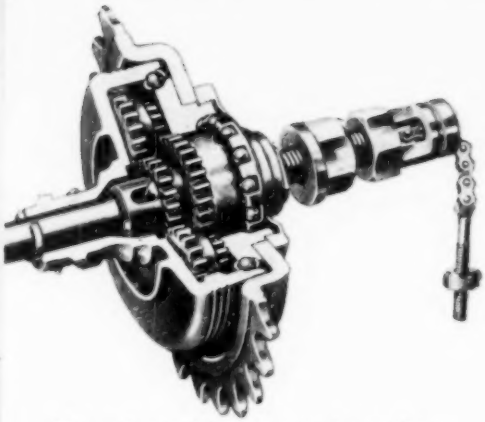


TO CONFORM TO TAPER of existing stone walls, which narrow at top, outer steel columns will be stepped outward on upper floors.

MOST DELICATE JOB will be leveling up walls where they have sagged. Jacks, set in slots atop concrete piers, will inch walls upward, then gaps left at base of walls will be filled with cement. Piers were replaced in alternate 4-foot-square blocks, as shown by different shading, so wall was always supported.







U. S. Makes New Bike Shift

This new three-speed transmission gives a bicycle as many forward gears as an automobile. Made by the New Departure division of General Motors, it is designed to fit any bike having a New Departure coaster brake and can be installed in 20 minutes.

The unit consists of a sprocket and gear assembly, as shown in the cutaway above, that fits into the rear-wheel hub in place of the original sprocket. In low gear, hub and sprocket are locked, providing a direct drive that is 25 percent lower than normal, for easier hill climbing. In second, the hub turns slightly faster than the sprocket, providing a normal riding gear. In high, the hub turns still faster, providing a 33-percent "overdrive" for speed on slight downgrades.

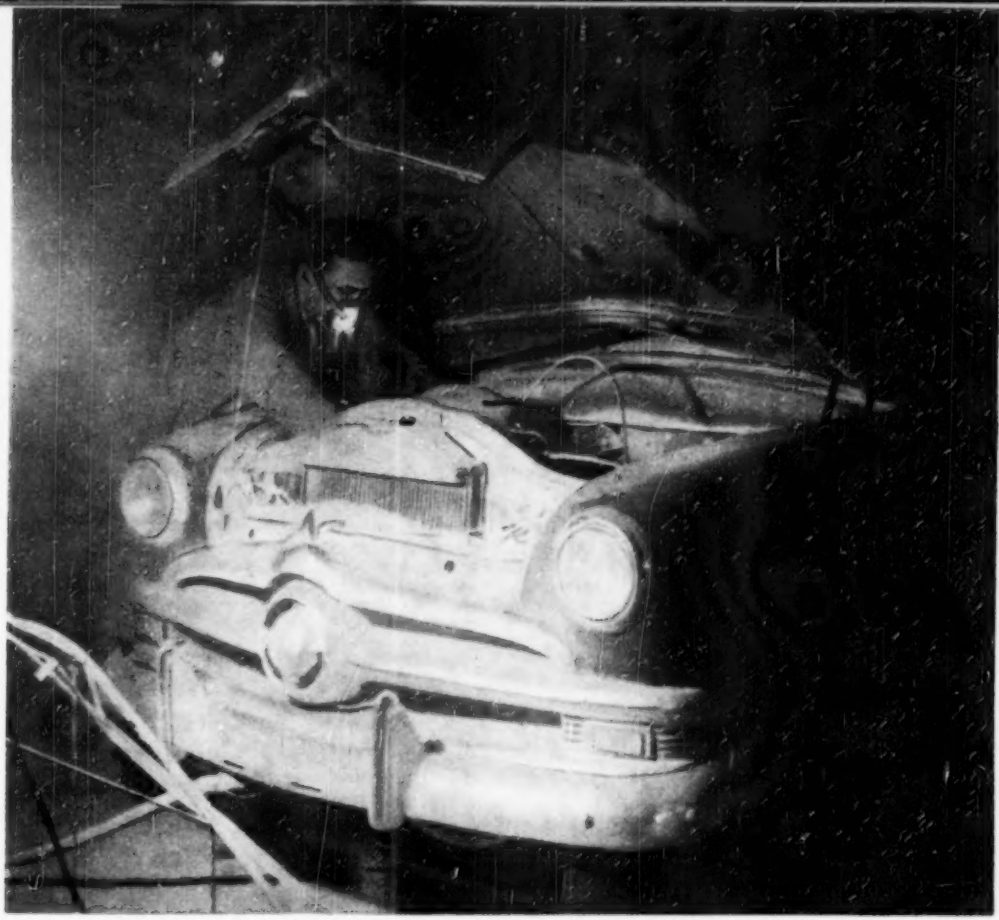
Shifting is controlled by a cable, connected to a lever on the handle bars, that moves a sliding clutch gear back and forth inside to engage the desired set of gears. Normal braking and coasting are possible in each gear, and gears may be shifted at any time without clashing. The conversion unit, out next month, will sell for $14.50.

Storm Window Tacks Up

You can put up this clear-plastic storm window (right) in a few minutes for $1. Called Pro-Tex-Mor, it is said to have the insulation qualities of regular glass windows. The 36- by 72-inch sheets come complete with framing strips and tacks. Made by Central States Paper and Bag Co., St. Louis, Mo., they are sold by Bingham's, New York.

Flexible Spouts Turn Corners

This new flexible-plastic spout bends to help you reach in tight spots. For use on cans of oil, lighter fluid, and other liquids, the spouts are said to be more durable than metal ones, and can be tightly capped. West Penn Oil, Warren, Pa., makes them.



Engineer makes adjustment on car in Fram Corp. dust tunnel. Gas mask protects his lungs from fog of fine dust that hangs in air for hours after operations in tunnel have been shut down.

Cars Commit Suicide in Self-Powered Dust Storm

Spinning wheels of chained-down test cars blow up a tornado of abrasive dust to show engineers what ruins a motor.

By Devon Francis

NEAR the sleepy hamlet of Dexter, Michigan, they are wrecking automobiles without laying a hand on them. The automobiles don't even move. They are chained down in a room 80 feet long and 15 feet wide. There, running at the equivalent of 60 m.p.h., they proceed to wreck themselves.

What wrecks them is dust—dust fed into the room in storm quantities. Dust can make a perfectly good engine give up its mechanical ghost in as little as three hours.

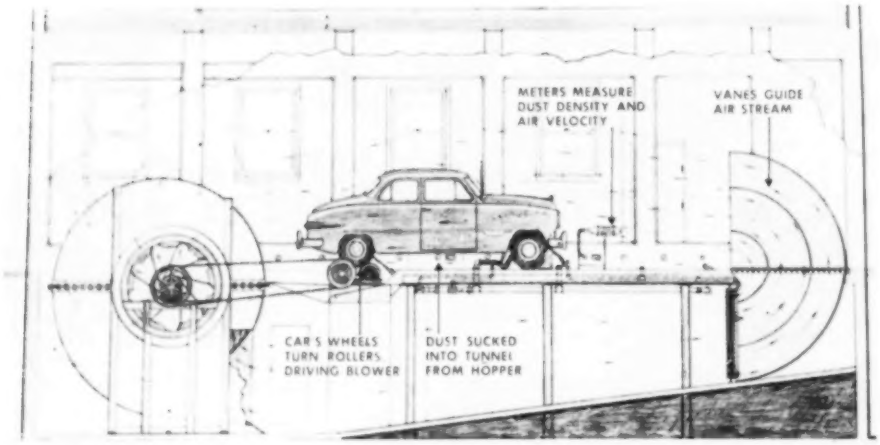
Dust plugs carburetors. Dust pits distrib-

Ford 6, used in tests, is chained down. Rear wheels turn 16-in. rollers that are linked by multiple V belts to big blower in back. Hoses supply water at controlled temperature to engine, which turns at equivalent of 60 m.p.h. under blower load at full throttle. Special pumps simulate water-pump load. The exhaust gases are piped outside.

utor points. Dust gets into voltage regulators and causes contact points to fail. Dust ruins generators, grinds cylinders out of round, wears down rings until there isn't enough power left to blow the hair off a gnat's eyebrow, and makes rod and main bearings set up an anvil chorus.

Destroying engines with dust is a project of the Fram Corporation, of Providence, R. I., the world's biggest manufacturers of oil filters. Fram established the first commercial U. S. dust tunnel—dirty brother to aviation's better-known wind tunnel—only last year to find out what happens to internal-combustion engines not protected from dust, and what could be done to control it.

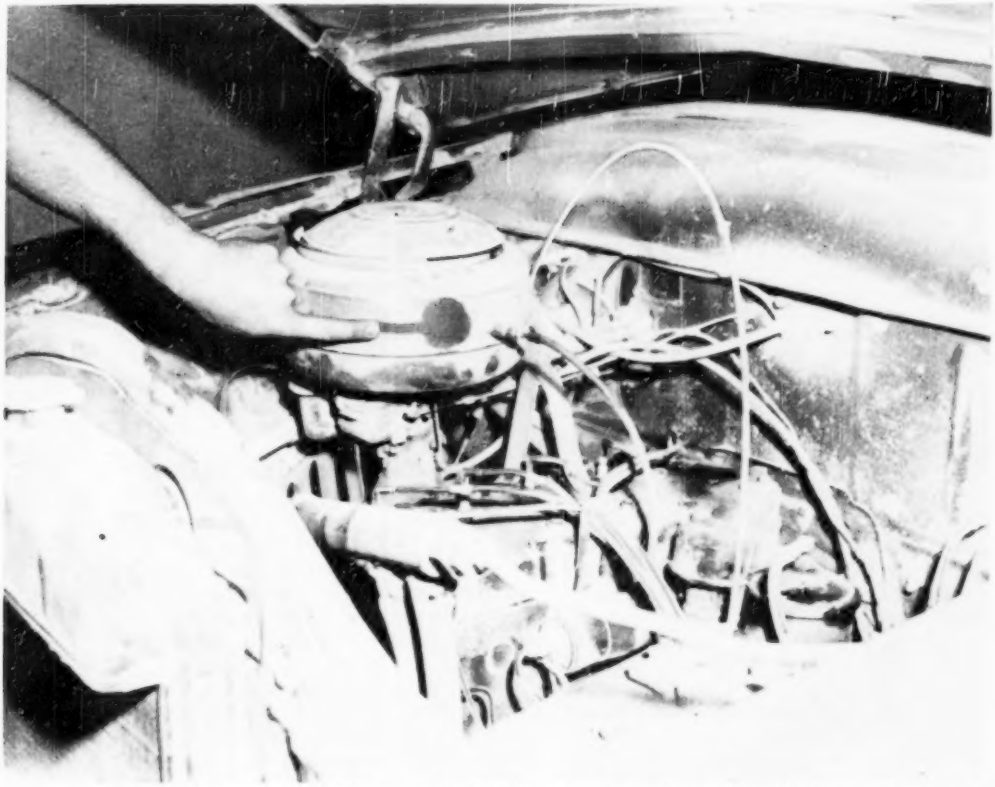
Like human beings, engines breathe. When they breathe dust, trouble starts. It isn't use that can cause engines to wear out in their youth. It's microscopic grit. Engines get dust through unprotected carburetors, crankcase breather tubes, the dip-stick holes, openings in fuel pumps and distributors, and leaky gaskets. Dust, in light or heavy concentration, is ever-present in the



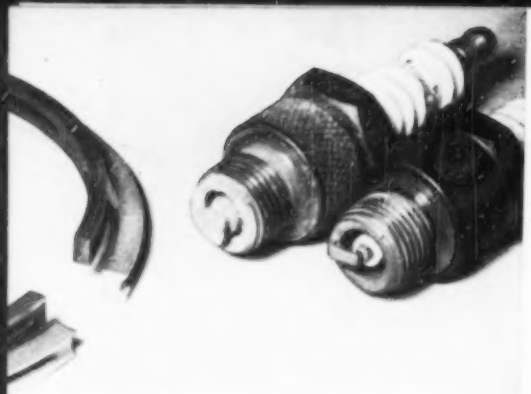
Dust-laden air is driven by the blower under the floor, turned by concentric vanes at the right, and blown past car at 25 m.p.h. Dust concentration is .0125 of gram to cubic foot of air.

Throttle, ignition controls are "remoted" to laboratory panel that supplies progressive data on car. Ford is equipped with racing-type tires. Rollers wore out regular tires too fast.

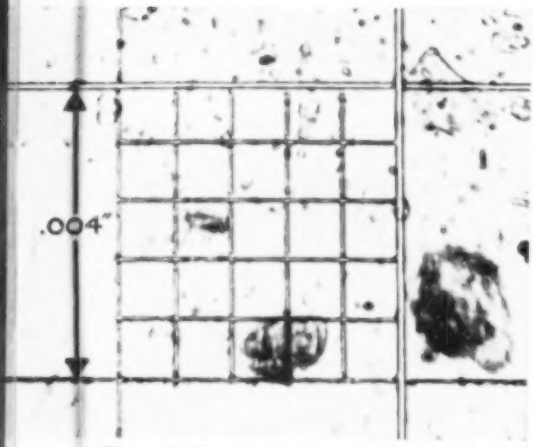
Dust in tunnel-feed hopper is finer than finest kitchen scouring powder. Screened down from special Arizona dust by General Motors' A. C. Spark Plug Division, it costs 70 cents a pound.



This is what an automobile engine looks like after a few hours in a dust storm. Finger drawn across air cleaner shows dust coat. Engines are run two hours between each refueling.



Wear and corrosion are shown in this contrast photo of used and unused rings and plugs. Groove on top oil ring has been worn away. Fouled plug barely gave spark.



This photomicrograph supplies an idea of what dust looks like when magnified 600 times. Finely graded for tunnel use, it nonetheless contains many jagged, abrasive chunks.

air. There's dust even on a sparkling winter day. There's dust on the finest of superhighways.

The Dexter dust tunnel, 50 miles west of Detroit, uses a lot of dust at one time to speed up the testing process. The tunnel provides controlled laboratory conditions to study the effects of dust. The Fram Corporation, which also makes other types of filters, including those to clean carburetor air, can test all kinds of filters in its dust tunnel. It can run engines in any concentration of dust it desires. It can run them with filters and without. Two cars are used. They are progressively wrecked and rebuilt.

In the clean air of their spick-and-span laboratory the engineers can peer through a window at the murk and the car under test, but precise information comes from instruments. They can tell, for instance, about how much piston rings are wearing down.

They do this by measuring "blow-by" into the crankcase. Flow meters show the amount of fresh ventilation air being drawn into the crankcase through the oil-filler tube, and the amount of air going out through the road draft tube. The difference is blow-by past piston and rings, and the amount is an index to ring wear.

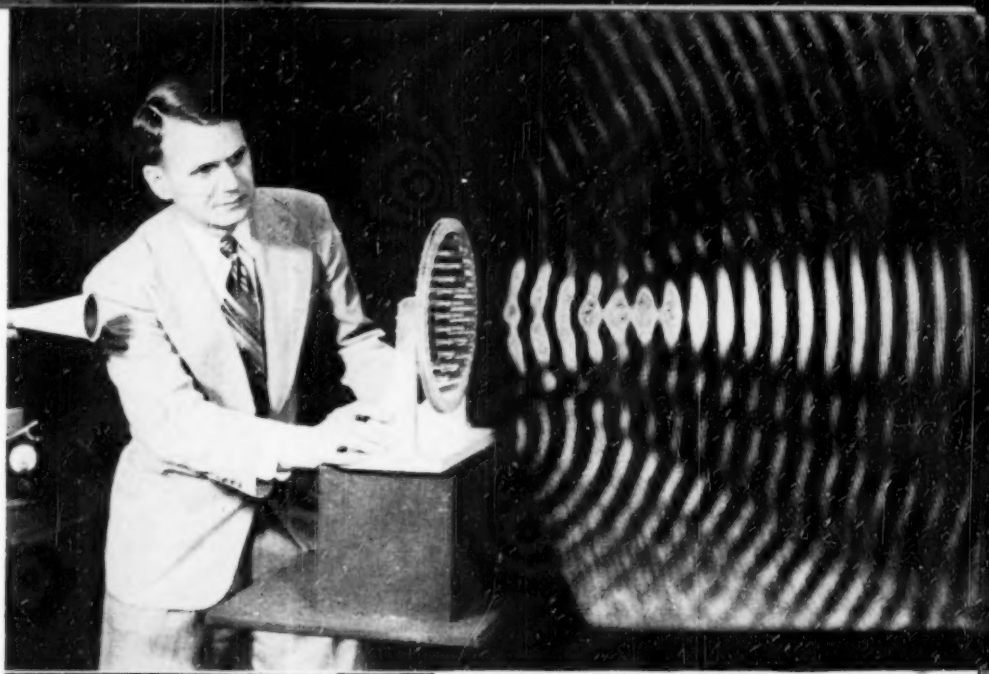
The real work starts when a run is over. Then an engine is taken apart piece by piece and measured. They carefully check for changes in ring thickness, clearance of rings in grooves, cylinder-bore diameter, bearing clearance, weight of bearing shells, diameter of main and connecting-rod bearings, bearing thickness, and increase in piston-ring gap.

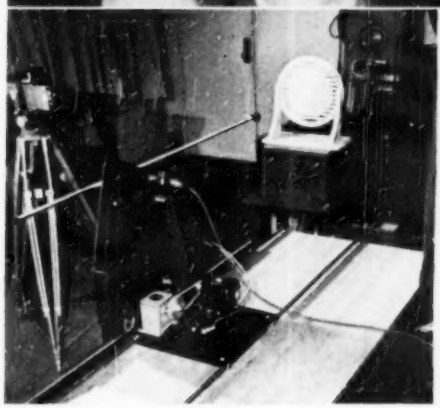
The dust tunnel, in future research, has a lot of questions to answer. It is going to tell, ultimately, whether dust particles of one size will wear out an engine faster than those of another size, whether dust particles of any one size won't hurt an engine at all, and how to measure the abrasiveness of types of dust.

But the engineers already have made some conclusions:

- Some oil-wetted types of carburetor air cleaners are practically useless in protecting an engine from dust.
- An oil-bath carburetor air cleaner will reduce ring and bore wear to a tenth of that with some oil-wetted types.
- An increase in the efficiency of a carburetor air cleaner by 1 percent—from 98.5 to 99.5 percent—will reduce engine wear by half.
- The use of a properly serviced oil filter will reduce wear on bearings by half or more and definitely reduce wear on the oil rings.
- Chrome-plated top rings will double the time an engine can be run until excessive blow-by occurs, will reduce bore wear by three-fourths, and cut the wear on lower plain rings.

They found out something else too—under meticulously controlled conditions, an adequately filtered engine *can* be run up to 20,000 miles without an oil change. But don't try it yourself. That's an experiment only for experts. END



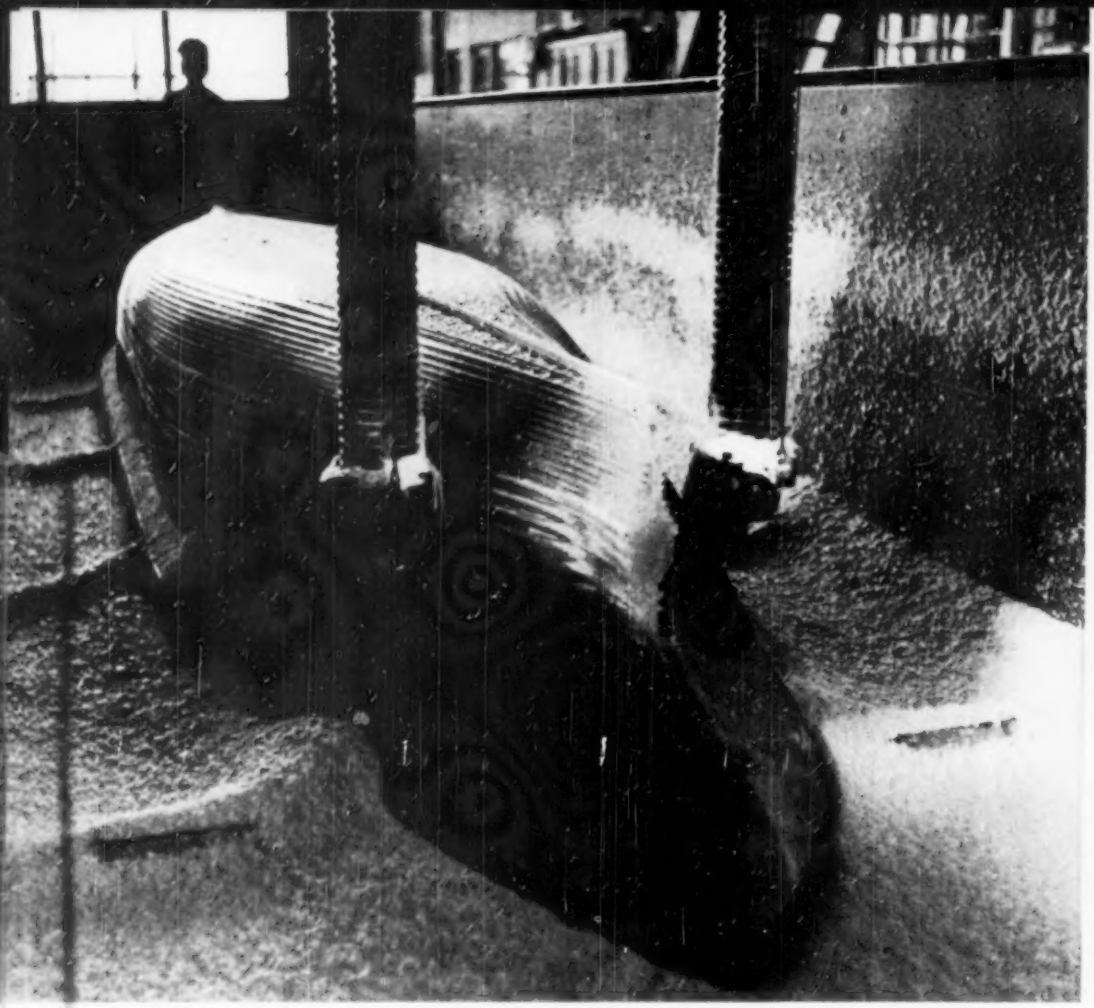


Neon Lamp Traces Sound Wave's Picture

THAT'S a sound wave you see in the picture above. Here demonstrating how an acoustic lens focuses sound from a horn, the wave was made visible with the device at left—an aluminum rod with a microphone and a neon lamp at the end. A small motor swings the rod in a wide arc, scanning the area. The microphone picks up the sound and turns it into electric current to feed the lamp. Wherever the sound is strongest, the light is brightest, and the wave is traced out. A complete sound photo, such as this from Bell Labs, takes 10 minutes exposure.

Production Line Spews Precision-Built Volcanoes

THE half a hundred stainless-steel cones arrayed at right tell a story of the mass production of turbojet engines for new U. S. warplanes. Precision-built to accuracies of less than 1/10,000th of an inch, the cones will handle the searing, 1,300° exhaust gases spewed back from the turbine blades of General Electric's powerful J-47 engines. The tail cones are shown in the final assembly room at the Ryan Aeronautical Co., San Diego, Calif., awaiting shipment for use in jet bombers and such high-speed fighters as the North American F-86.



Wax hull, on carriage, passes between cutter bars that spread and close to form contours.

Waxworks and Goldfish Help Design Ships

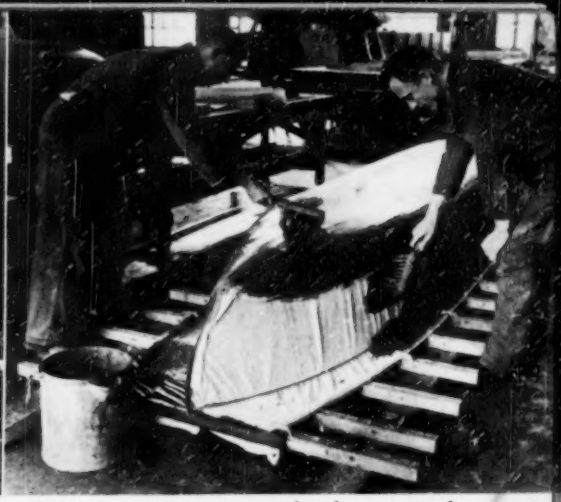
PHOTOS BY ERIC SCHAAL

A WAXWORKS, an indoor railway, and a school of goldfish help to design the ocean vessels of Europe's merchant marine.

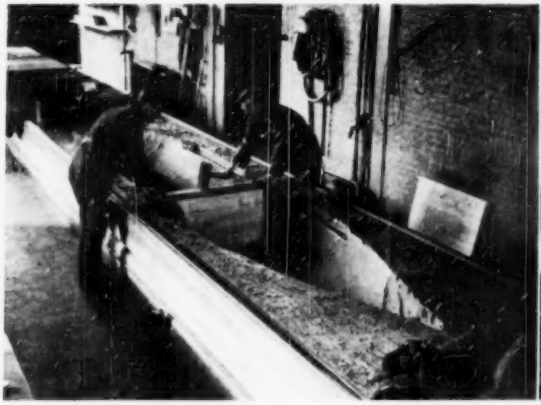
The scene is the ship-model test basin at Wageningen, Holland, one of the world's largest, and second only to the U. S. Navy's basin at Washington, D. C.

Ship models, molded of wax as shown in the accompanying photos, sail its miniature sea to test designs. An overhead railway guides them on a straight course. The goldfish keep the basin free of algae that would hinder delicate measurements of water friction on a hull, a factor that is minimized in best designs. Serving shipbuilders of many nations, the 160-yard basin will be enlarged with Marshall Plan aid.

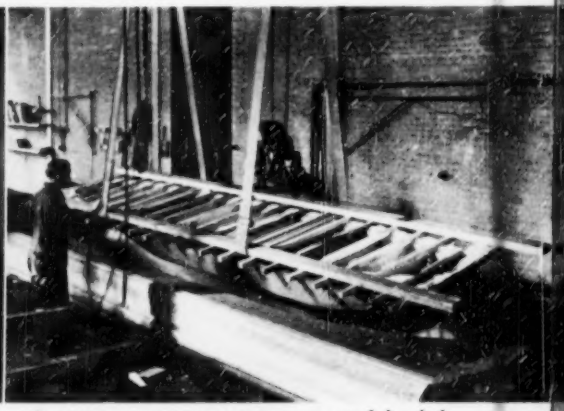
1 FIRST STEP in making a ship model is constructing a "core," or framework, of wooden sections and slats. It will form the inner part of the mold used to make the wax hull.



2 HERE COMPLETED CORE has been covered with linen fabric. Now it gets an application of clay water, "painted" on with brushes. This will prevent the paraffin from sticking to it.



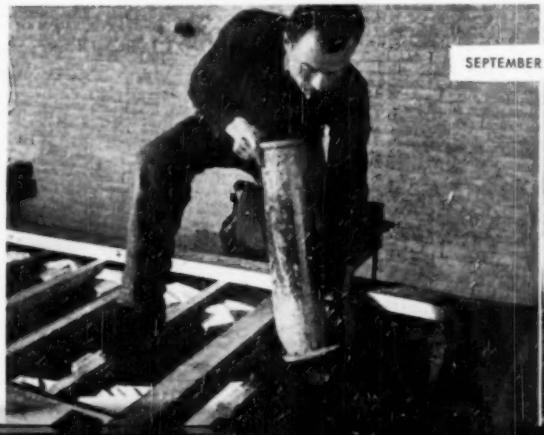
3 MEANWHILE, outer half of mold is formed of clay, in molding bin. Transverse section of wood is being inserted in hollowed-out clay to give right dimensions at that point.

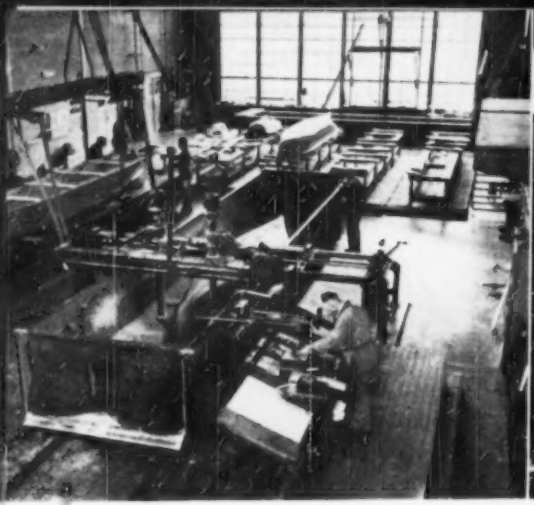


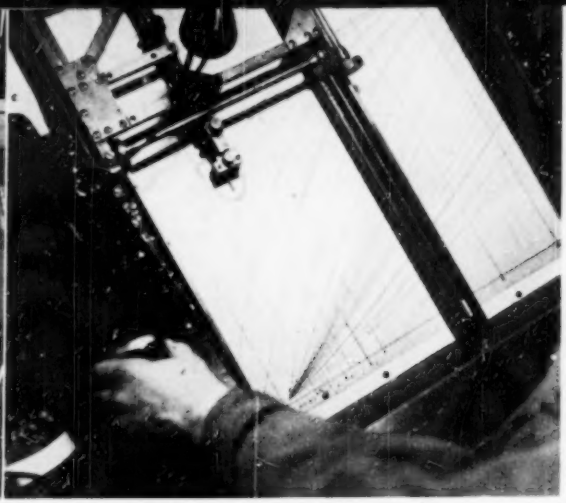
4 INNER PART OF MOLD, supported by ladder-like frame on which it was built up, is lowered into outer section. Gap left between the two parts of the mold shapes the model ship.

5 AN AIR VENT is placed at front of gap between molds. This permits the escape of air that will be displaced as molten paraffin flows into the narrow space from the opposite end.

6 HOT PARAFFIN WAX flows through tube into after end of mold. It cools in about 24 hours, forming ship model, which then is ready for final shaping. *[Continued on next page]*



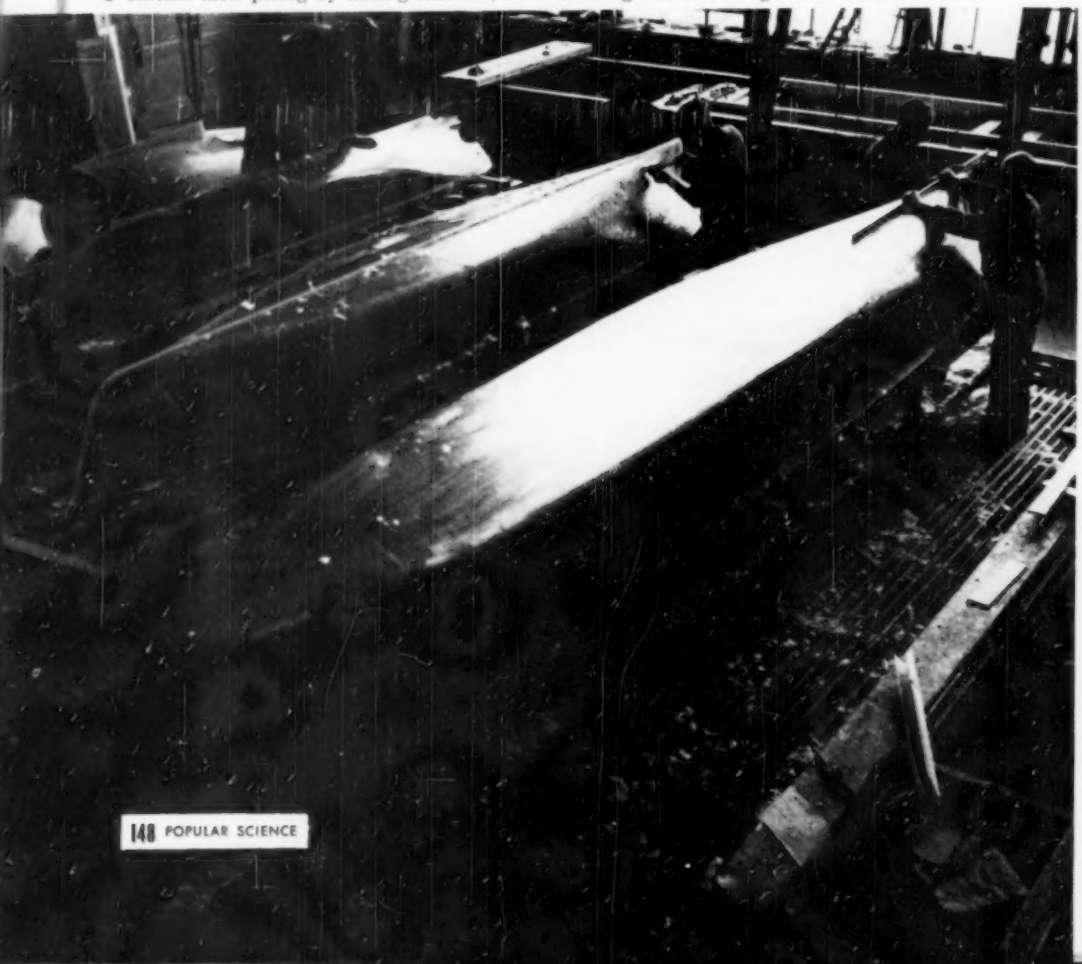


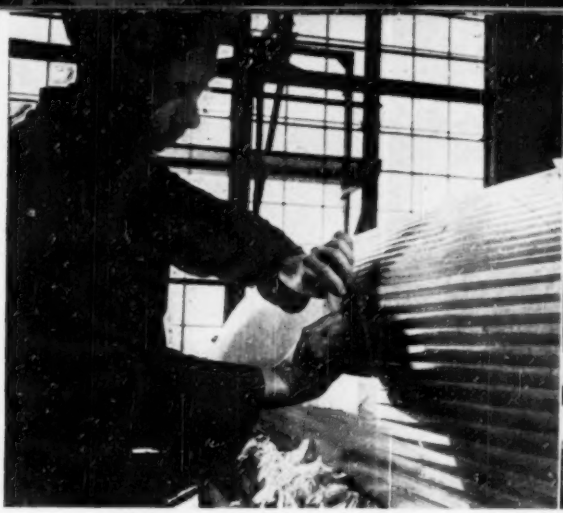


7 MOLDED WAX SHIP MODEL goes to milling machine, where operator shapes it to curves shown on a drawing. Above is over-all view of operation shown close-up on opening page.

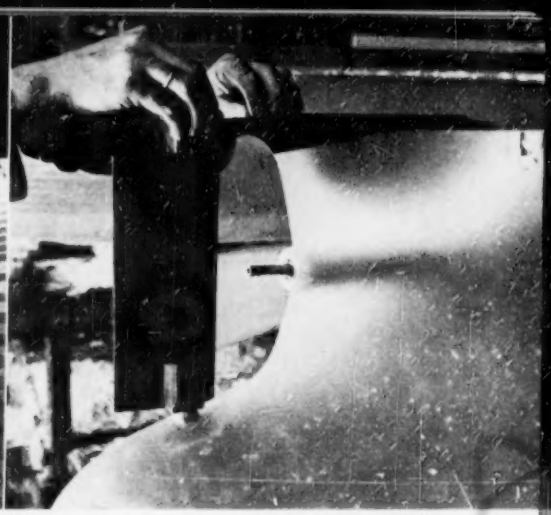
8 MILLING-MACHINE OPERATOR manipulates controls to guide a "feeler" along curve on drawing. Rotary cutters on machine's cutter bars transfer same curve to wax hull of model.

9 THREE MODELS BELOW, ready for finishing touches after paring by milling machine, illustrate range of sizes employed in the tests. The length of the average model exceeds 20 feet.



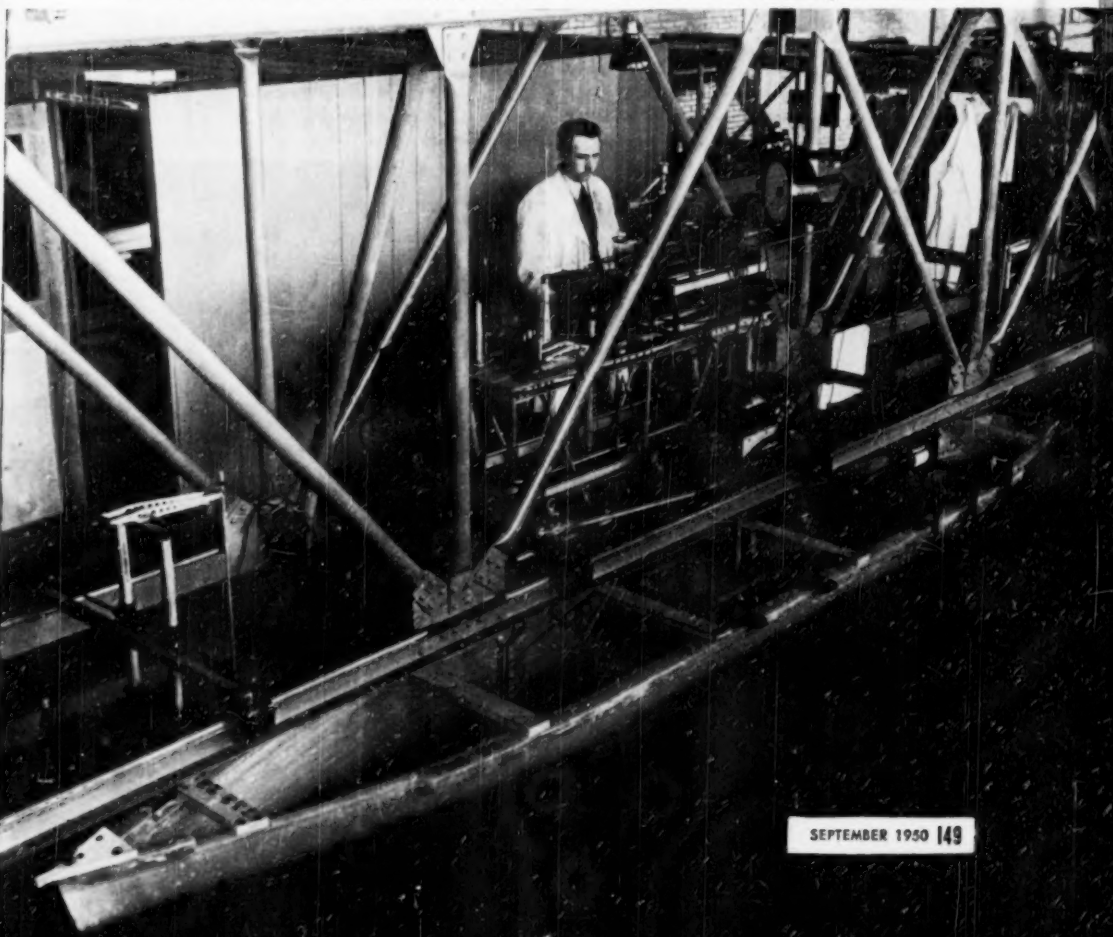


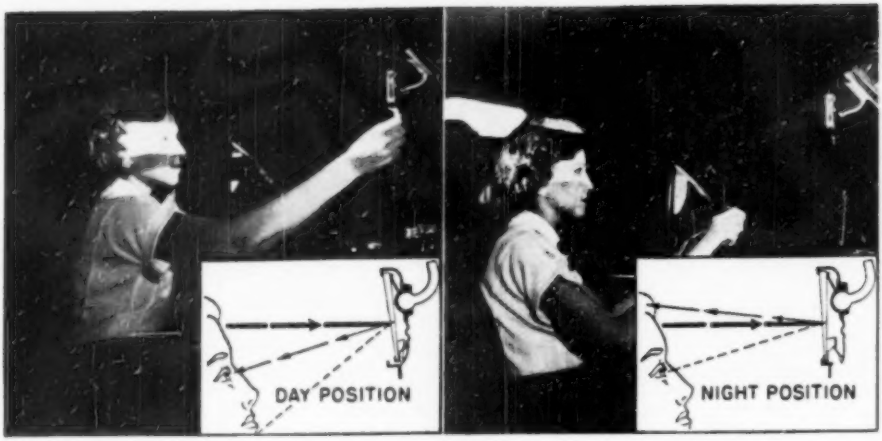
10 FINAL HAND-SMOOTHING is given wax hull. Advantage of wax models over wooden ones, often used in model-basin trials, is ease of altering lines to try effect of minor changes in design.



11 RUDDER IS FITTED to stern of wax model. Propeller shaft, seen protruding, awaits attachment of screw, which will be driven by an electric motor installed in the model hull.

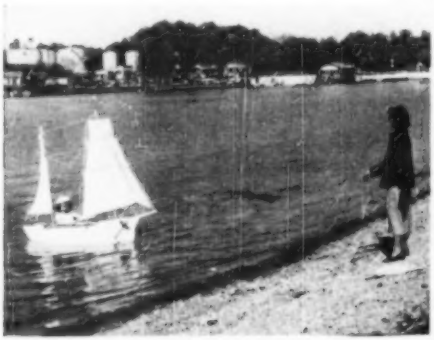
12 FINISHED MODEL is set for self-propelled test run in basin. Moving carriage, to which model is linked, does not tow it but merely guides it while instruments record performance data.





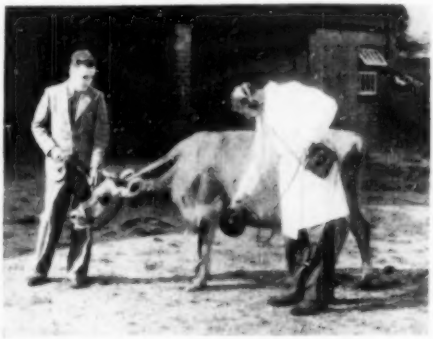
Prismatic Auto Mirror Cuts Headlight Glare

GLARE in the rear-view mirror from the headlights of the car behind is cleverly avoided by the mirror above. Front and back surfaces of the mirror are not quite parallel; in section, the mirror is slightly wedge-shaped. For daytime, bright-reflection use, the mirror is set so that you see the bright image that bounces off its silvered rear surface in the conventional way. At night the mirror is tipped up a little so that you see the dimmer, front-surface reflection—the same weak reflection you can see in store windows and unsilvered glass. The mirror, mounted so that it snaps easily to either position, was developed by General Motors' Guide Lamp division.



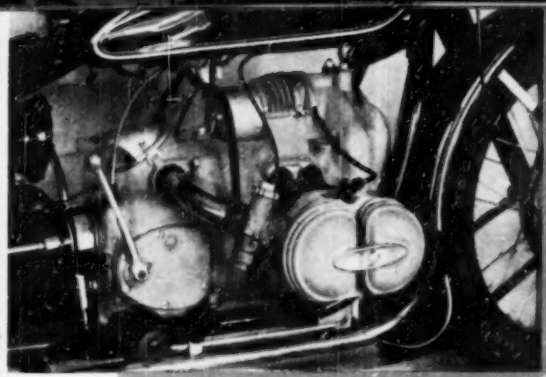
Midget Sailboats Built for Tots

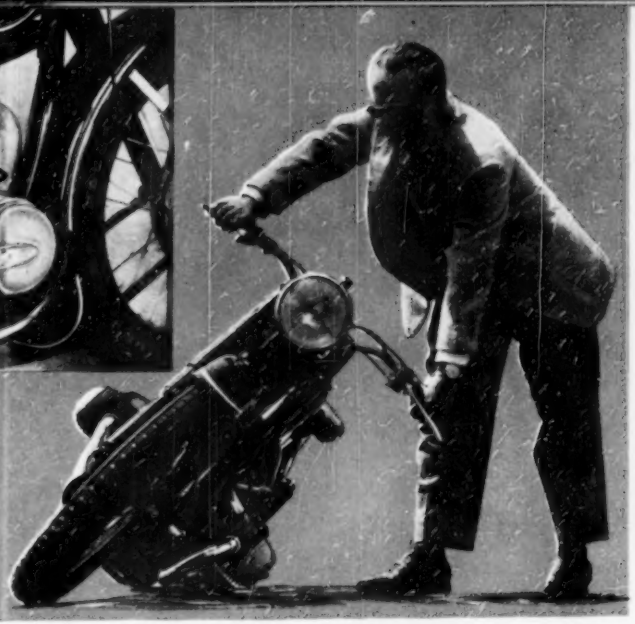
THE pint-size Columbus above sails the ocean blue in a pint-size sailing vessel, while Mother keeps in touch from shore via a safety line. Made by Sea Skates, Manhasset, N.Y., the keelless craft are 7 ft. 9 in. long with a beam of 2 ft. 6 in., draw only 6 in., and weigh under 50 pounds. The ¼-in. waterproof plywood hulls are fitted with four watertight compartments. The "Buccaneer" model shown, for small fry, is square rigged; the "Hornet" model, the same hull with jib and mainsail, is for older kids.



Mine Detector Diagnoses Cows

THE man in the white coat above doesn't think that Bossy has a Tellermine in her cud, but he is checking to see if she's munched a nail, screw, or bit of barbed wire. Because cows sometimes eat metal objects that cause sickness, British vets use mine detectors along with their stethoscopes. Other uses for surplus detectors are to locate metal embedded in logs that might shatter saw blades, and to spot the hairpins that women workers tend to shed into food-package assembly lines.



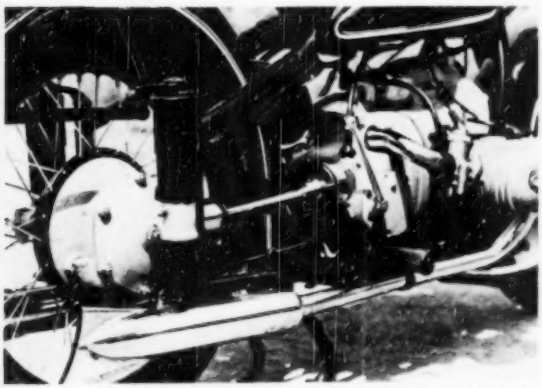


Opposed twin-cylinder engine of new German cycle, above, has dual carburetors. Note auxiliary hand gearshift supplementing foot control. At right, man shows cycle could bank to 45° angle with clearance between cylinder head and road.

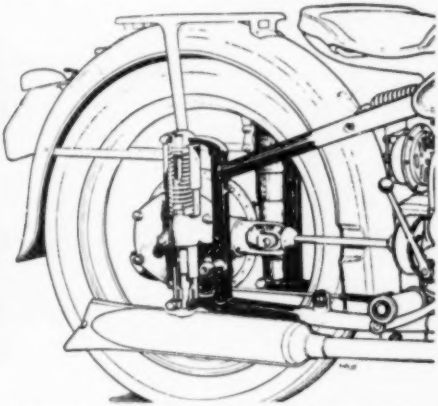
U. S. Gets New German Motorcycles

POSTWAR motorcycles are arriving for sale in this country from the American Zone in Germany. The Bavarian Motor Works of Munich, which produced the standard German army motorcycle, now offers U. S. enthusiasts a 30.51 cu. in. twin-cylinder sports model and a 15.25 cu. in. single-cylinder touring model. Both feature shaft drive, coil ignition, rear-wheel suspension, and transmission integral with engine housing.

The new BMW twin, pictured on this page, develops 24 hp. and has a rated speed of 85 m.p.h. at 5,800 r.p.m., using a compression ratio of 6.3 to 1. Its engine has horizontally opposed cylinders with separate carburetors. It uses ball bearings for the crankshaft, roller bearings for the con rods, and needle bearings for the rockers. A six-volt electrical system includes an air-cooled 75-watt generator, a 12-ampere-hour storage battery, and a Bosch coil. The model is called a direct descendant of a BMW twin that in 1937 set a world's speed record.



Engine transmits power through single-plate clutch, four-speed transmission, and shaft drive to spiral-tooth bevel gear at rear wheel. Rear suspension provides over-all 3-in. movement.



Cutaway view of drive shaft and rear suspension shows universal joint for shaft and springing for wheel. Rubber couplings in power train eliminate shaft whip and vibration.

New Machines Help Fight Forest Fires

Helicopter acts as aerial eyes for fire-fighting team, also hauls men and equipment to scene.

It still takes sweat to put out forest fires, but new equipment, from flails to flame throwers, does more of the work.

FIRE fighters are dipping into a big bag of mechanical tricks to help combat the roaring flames that each year sweep our forests. The red-eyed, foot-slogging smoke eater, with his shovel, hoe, McCloud (giant hoe-rake), or Pulaski (an ax-mattock), hasn't been rendered obsolete. But an imposing array of mechanical muscles are taking part of the load off his aching back.

These include airplanes and helicopters for spotting fires and moving men and equipment; giant bulldozers and mechanized plows for rooting out firebreaks; light, fast pumper trucks that get to little fires before they become big ones; AM and FM radios; and flame throwers for setting backfires.

Last year forest fires burned more square miles of timber than the combined areas of Massachusetts, Connecticut, Rhode Island, New Jersey, Delaware, and the District of Columbia. Enough saw timber to build an estimated 80,000 five-room houses went up in smoke, and enough pulp-size trees to supply every newspaper in the country with newsprint for a year. The only bright spot in this picture is that less than half of one percent of the total area under state and federal fire-fighting protection was burned, whereas almost 16 percent of the unprotected land was swept by flame. That the damage on protected land is so low is due in considerable part to both the improved and the brand-new machines now on the job.

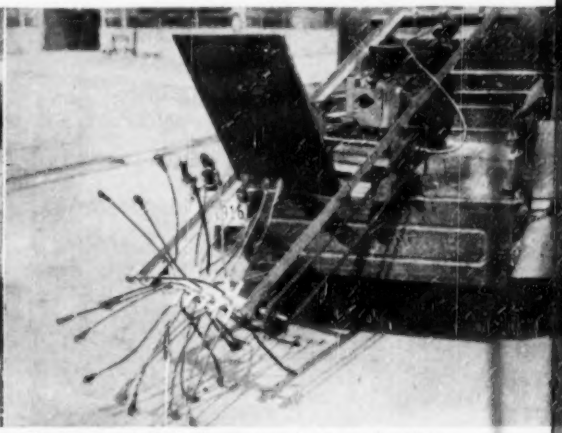
Probably the biggest news in the field is the swing to lighter equipment that uses less water. Through tests at its Arcadia, Calif., equipment center, the Forest Service has decided that the big, old-fashioned tank truck is obsolete. They've found that it's better to reach a fire early with a little water than to get there later with a lot.

So the newest wrinkle in tank trucks is the "slip-on" job. This is a light truck, usually a 1½-ton Ford or a one-ton Willys. A slip-on unit, consisting of a water tank, hose,

For Florida swamp fires, Forest Service uses this high-wheeled marsh buggy. It has water tank, hose, hand tools, and seats for fire fighters.

"Pulvimixer" has four-foot rotor with curved blades that break up and bury surface growth and litter. Pulled by tractor, it goes 2-3 m.p.h.

Clearing mine fields in wartime suggested development of this flail. It's used in Western lava beds where cover, though scanty, spreads a fire.



Close-up of flail shows two-foot steel cables that whip undergrowth. Ten-hp. engine turns brush at 400 r.p.m. Shield protects operator.

Workhorse of the Forest Service for clearing heavily wooded country is still the big cat.

Standard Ford 1½-ton truck is converted to fire fighting by bolting slip-on unit to truck bed. Only other connection between pumper unit and truck is siren cable. Pump units can be changed in 15 minutes. Rig carries 1,650 feet of 1-in. and 1½-in. hose, which can be run simultaneously from reel and from open bed on top. Variety of nozzles meets various fire conditions.

Rotary trencher is cross between plow and baby bulldozer. Opposed spirals peel off thin layers of soil and build ridges on each side. Machine cuts 18-in. trail at a walking pace.

Low-pressure flame thrower is used to start backfires. It burns Diesel oil at pressures as low as 20 lb., discharges four gallons of fuel on one 80-lb. charge of air. Effective range is 12 ft.

hand tools, pump, and engine, can be quickly swung onto the truck bed and bolted down. While the operation takes only 15 minutes for the Ford and seven for the Willys, it can of course be done in advance during times of fire peril. The slip-on feature means economy since the trucks can at other times be used for cargo-carrying jobs.

Another fire fighter that has been more than earning its keep is the helicopter, used for fire spotting and hauling men and supplies. With it many a small fire has been scotched before it could do much damage. Smoke eaters used to reach a mountain fire dead tired from lugging their tools up steep trails. Now a helicopter delivers them in a matter of minutes, fresh and ready to go. As many as 10 'copters have been used simultaneously on a big fire.

About the only equipment that has thus far resisted the trend to lighter weight and smaller size is the tractor. The big cat is still the Number One firebreak tool, especially in heavily wooded mountains.

But in lighter cover and more rolling country another breed of machines, new to the forests, is coming into play. These are modifications of the common or garden variety of midget tractor. Some are used to pack small loads. Others have little dozer blades to push through light brush and duff —that combustible carpet on the forest floor that makes fires mean to control.

One of the more promising midgets is the rotary trencher, developed at the Forest Service's Portland, Ore., lab. The opposed spirals of this 530-pound machine dig out

Close-up shows 10-hp. pumper unit mounted on 1½-ton truck. It delivers 30 gallons of water per minute from 300-gal. tank at 250-lb. pressure. Pair of 6-volt batteries furnish juice.

Extra lengths of hose are neatly stowed in lockers on side. Similar compartment carries hand tools, including axes, shovels, McClouds, Pulaskis, brush hooks, wire cutter, pinch bar.

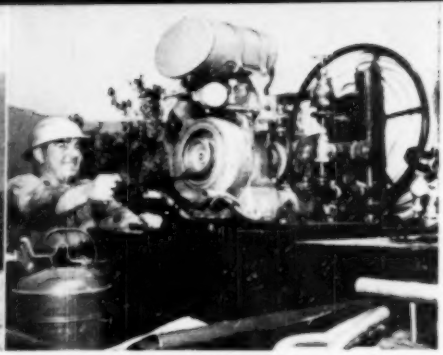
grass and loose cover, piling dirt neatly at the sides in parallel ridges. Powered with a 6-horse engine, it lets one man clear an 18-inch path as fast as 25 men with hand tools.

But when the wind howls through tinder-dry woods, firebreaks and water won't stop a blaze. Then fire must fight fire. So every tanker carries a flame thrower to set new blazes upwind from the advancing flames, to burn out a big firebreak. Forest Service flame throwers, unlike military models, have low pressure and short range. These combine to spread a heavy film of oil over vegetation to start the backfire fast.

These and other gadgets are making the task of the fire fighter much easier. But even they can't do much about what the Forest Service calls "the three main causes of fires—men, women, and children."—*John F. Loosbrock.*

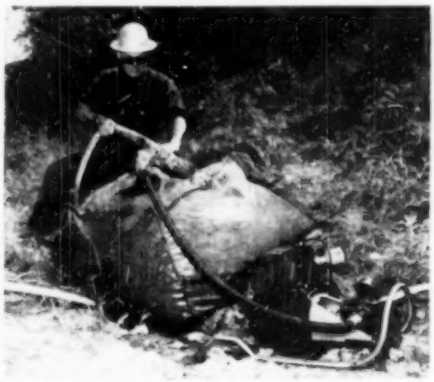
If fire-fighting crews get to blaze before it spreads over wide area, water will usually kill it. Here an engineer watches pumper engine at brush fire. [*Continued on next page*]

One-ton Willys carries 160 gal. of water in three compartments. Single-cylinder, four-cycle engine develops six hp., pumps 18 gal. per minute at 250-lb. pressure.



One man can operate Willys, called "year-round toolbox tanker." After starting engine with pull-cable, he unreels hose, runs to blaze. Engine runs four hours on two gallons of gas.

When no other power is available, small one-cylinder engine mounted on skids can pump from stream or act as booster on long hose line. Two men can easily carry the 94-lb., 6-hp. outfit.



Auxiliary canvas tanks are being tried by Forest Service in three sizes—150, 300, and 600 gal. This is 300-gal. tank, treated for mildew. Tank hugs ground, can be used on hills.

Any water remaining in tank after use is sucked through strainer back into pumper truck's tanks. Strainer is also used when drawing water from lake or stream, prevents clogging of hose.

Forest Service engineers are constantly looking for new fire-fighting tools. This experimental model is a collapsible rubber back-pack bag that carries five gallons of water plus hand pump.

Mower Hugs Uneven Ground

GLIDING smoothly on a curved skid at its front, a power lawn mower of new wheelless design (above, right) hugs uneven ground to cut a swath of uniform height. Propelled by a four-cycle engine and cleated traction rollers, it is easily maneuvered among shrubs and trees. A whirling cutter bar is tipped with quick-removable blades, discarded and replaced at less than the expense of sharpening and adjusting conventional types. A steel-toothed safety guard is removed to show blades and traction rollers in underside view at left above. Called "Snappin' Turtle," the mower is made by Whirler-Glide Mower Co., Montverde, Fla., in three sizes, 18 to 36 inches wide.

Quick Shine for Your Car

A NEW liquid wax called Car-Plate makes the family car shine like new in 20 minutes, after a preliminary cleaning. You simply wipe it on, let it dry, and wipe it off (left), saving hours of polishing with a standard paste wax. Sponsor is S. C. Johnson & Sons, of Racine, Wis., leading maker of wax products. A similarly timesaving, waxless finish known as Autobrite (inset) has been introduced by Boyle-Midway, Inc., of Cranford, N. J. and Los Angeles. It contains a cleaner and weatherproof, war-developed silicone chemicals.

Atlantic Sky "Queen"

A HUNDRED passengers will be able to relax in spacious comfort aboard Britain's new Bristol Brabazon air liner, largest of its kind. The first one test-flown, an experimental prototype, has ample room to seat six abreast, as shown at right. Three of the Brabazons have been ordered for New York-London transatlantic service. An aerial counterpart of the famous "Queens" afloat, the eight-engined, 130-ton giant has a wingspread of 230 feet, nearly the length of a city block.

President Gets New Convertible

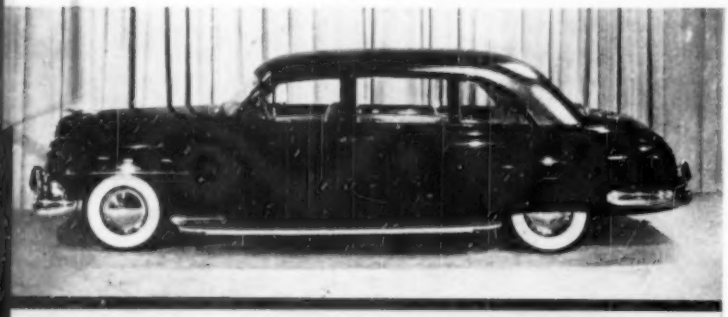
THE man in the White House took delivery the other day of a specially built seven-passenger Lincoln convertible with disappearing steps on which Secret Service men ride like footmen. Last of 10 cars built for Mr. Truman, his family, and distinguished visitors, it has a 145-inch wheelbase compared with 125 on the Lincoln Cosmopolitan. It has an over-all length of 20 feet compared with the standard 18½.

The other nine cars are limousines. Four of the nine, used by the First Family itself, have gold-plated fittings. The remaining five, with chrome substituted for the gold plate, are for distinguished visitors.

The cars have the regular 152-hp. V-8 engines, with heavy-duty Hydra-Matic transmissions. Their curb weight ranges from 6,100 to around 6,500 pounds—some 1,700 more than the regular Cosmopolitan. Special equipment on the convertible includes a warning siren and a flashing red light. All cars have an extra rear-seat heater. Coal-black, the convertible has white sidewall tires, red-and-black leather upholstery, a tan top, and two jump seats.

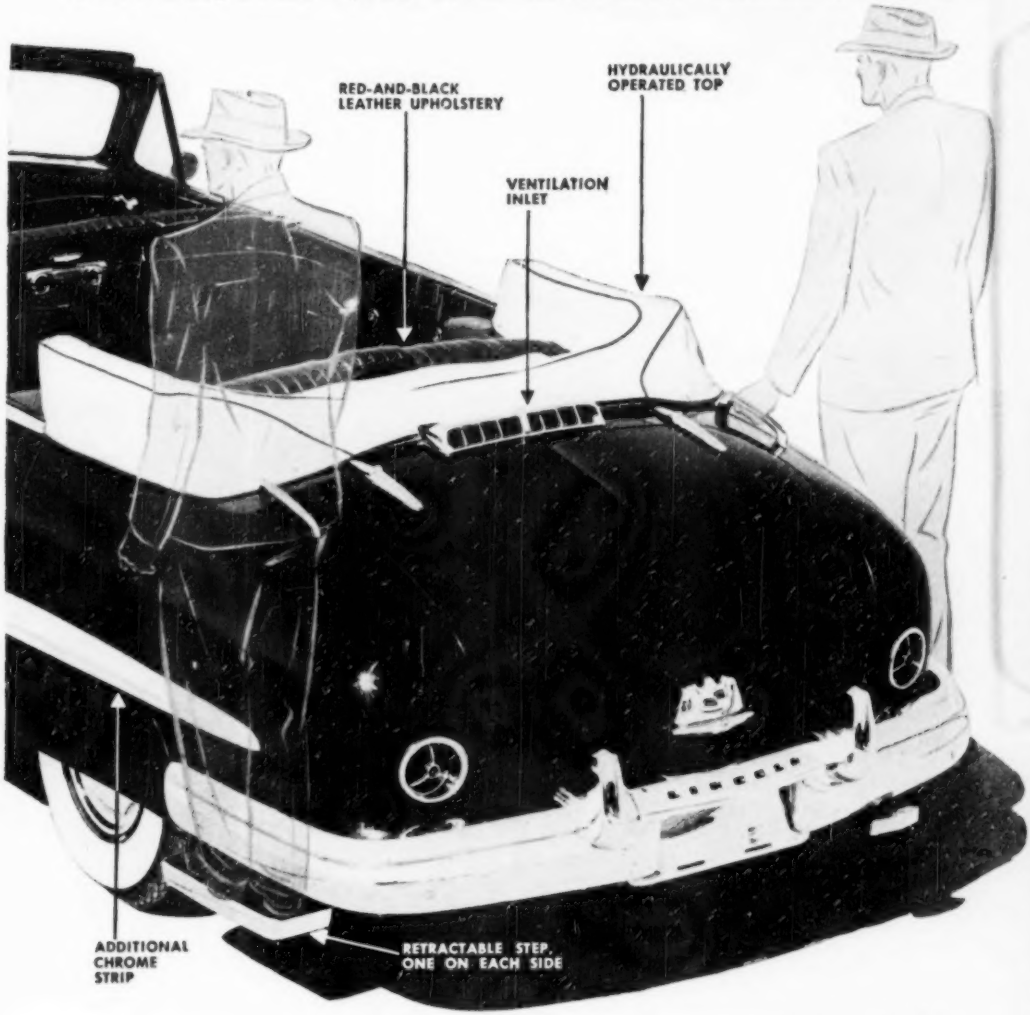
To strengthen the extra-long frames, a cap of ⅛-inch steel was welded to the longitudinal members and crosspieces. Limousine tops have one regular top and part of another welded together. Lengthening drive shafts required adding a universal joint.

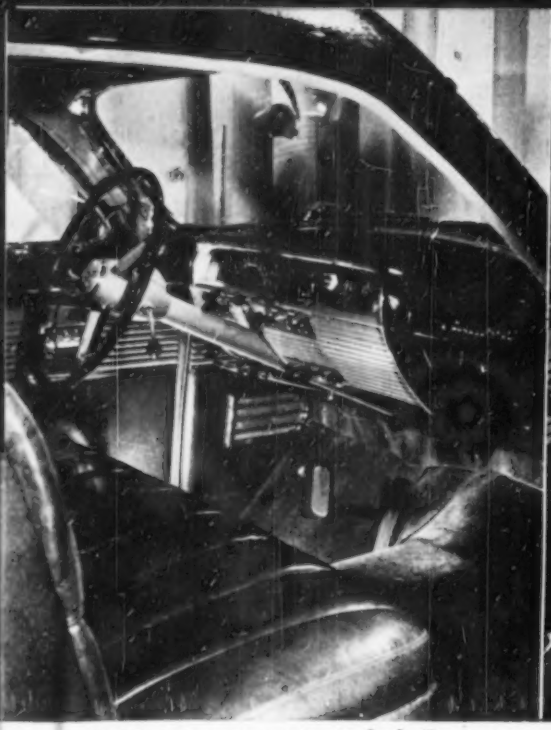
The convertible body was built by Dietrich Creative Industries, Inc., of Grand Rapids, Mich., the limousine bodies by Henney Motor Co., of Freeport, Ill.



Of the 10 new White House Lincolns, nine look like top car at left. Lone convertible is for parades and reviews. Rear-compartment heating and ventilating units are controlled by passengers. Passengers can talk to driver through microphone. Convertible's king-size top is hydraulically operated. Cars are leased to government by Ford Motor Co. at "nominal sum."

In manufacture, workman files down seams where extra-long limousine tops were welded together. Convertible's steps (below) extend, retract manually. *[Continued on next page]*

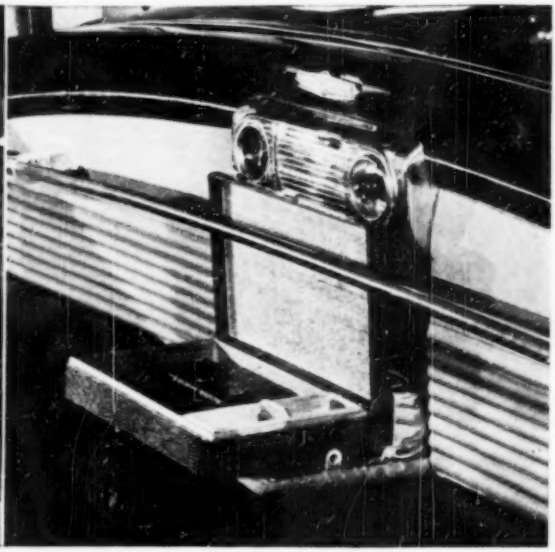




Driving compartment is standard. Front, rear seats have individual heaters. Cars have sponge-rubber carpets impregnated with mohair. All seats have padding of finest virgin wool.

Each car has two jump seats. Two of the four family Lincolns are equipped with vacuum flask, writing case, cigarette case in one of two arm rests, all encased in brown lizard skin.

Pillar support for convertible's top folds sideways into partition and then is covered by hinged cap. Convertible is only one of the 10 cars without an extra radio for rear-seat passengers.

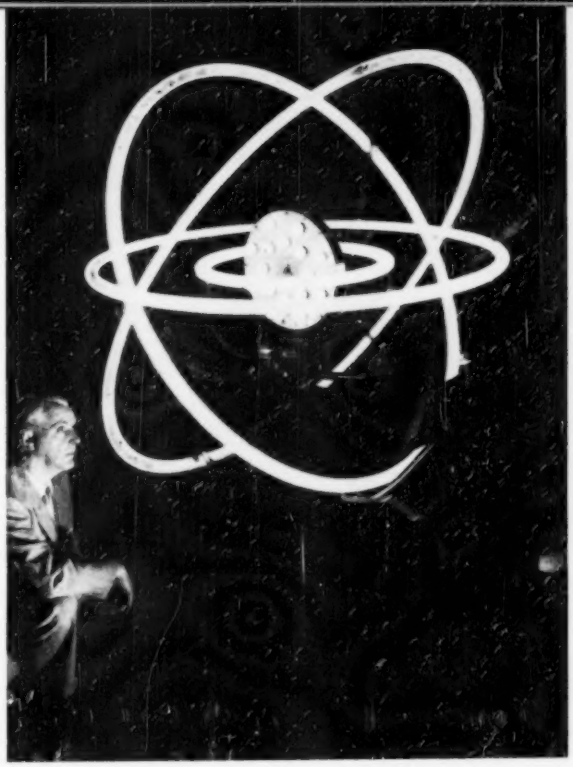


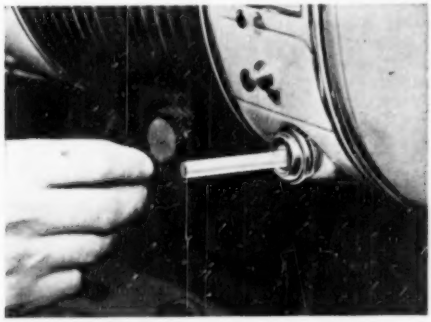
Cigarette-cigar trays are built into partitions. Two of family's four ladies' cars have writing and vanity cases and gold pens and pencils, all covered with gold crocodile leather.

Lights Whirl in Atom Model

HERE's what an atom of oxygen might look like if it were enlarged billions of times. The three-dimensional atom model, created by Dr. Richard C. Hitchcock of Westinghouse, can depict any atom up to and including oxygen in the periodic scale.

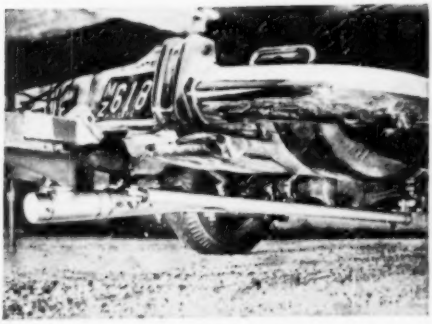
The atom nucleus is the disk-shaped center piece with red lights representing protons and blue lights neutrons. Orbits traveled by electrons are made by clear light bulbs at the end of transparent plastic arms (in time exposure at right, the bulbs make continuous trails) whirling in different planes. Even fission can be illustrated: a Ping-pong ball is tossed into the nucleus, causing a flashbulb flare and immediate changes in the orbit light circuits.





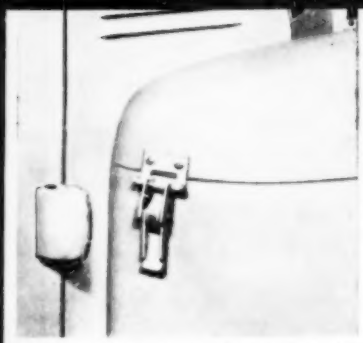
Lighter Puffs Cigarette for You

INSERT a cigarette into the new Draw-Matic car lighter, push the surrounding ring in, and in a few seconds the ring pops back to deliver a well-lighted cigarette. The first few puffs needed to give a sure, even light are supplied by the device itself, which is linked to the wiper vacuum line. The makers, Dowi Products, Inc., of Milwaukee, say you can use the lighter without taking your eyes off the road for even an instant, and without danger of burning your fingers on a glowing coil. The gadget, which can be easily hooked up, sells for $2.75.



Trailer Hitch Hooks To Axle

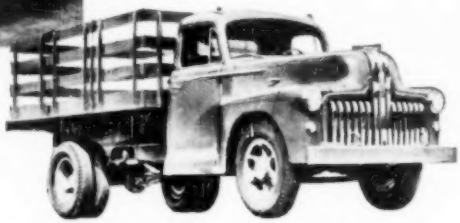
THE house-trailer hitch above removes all hitch weight from the car springs. The 147-pound, all-welded steel Trailmaster is attached to the auto by means of clevises bolted around the axle housing on each side of the differential. Springs inside the two radial tubes running back from the axle take up road shock. The whole unit amounts to an extension of the trailer tongue, rigid in the vertical plane but free to pivot horizontally at a joint just behind the car bumper. The hitch is made by Marine Safety Equipment Co., Point Pleasant, N. J.



Release the clasp above, and the middle section of the three-part fender can be swung up out of the way (left) to give easy access to engine. Inner splash shield comes out easily. The louvers above fender clasp are part of cab-ventilating system. Radiator in trucks is mounted so that it can be pulled in 10 minutes. Engines available are from 96 to 131 hp.

Fenders Swing Up for Fast Fixes

By R. P. Stevenson



With fenders folded back into place, truck looks conventional. Other changes in new Federal line include heavier brakes with self-contained booster units, beefed-up frames, and roomier cabs with adjustable seats. Wider track in front provides shorter turning radius.

A MECHANIC doesn't have to stand on his head to service the engine of a new Federal truck. To prepare for the job, he just:

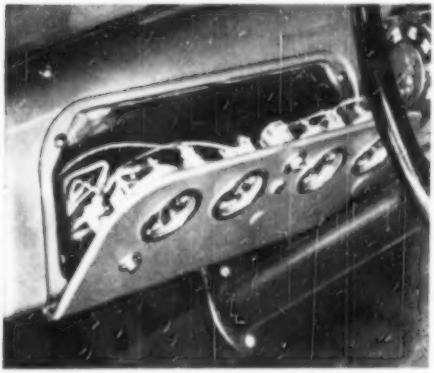
- Raises the separate halves of the butterfly hood;
- Releases a couple of catches and swings the front fenders up and forward; and then
- Removes the fender splash shields.

After this, which only takes him a couple of minutes, he has practically unobstructed access to the engine, its accessories, the steering gear, and the front brakes.

The swing-lift fenders are an exclusive feature of a new series of light and medium duty commercial vehicles just announced by the Federal Motor Truck Company. Pivoted on concealed hinges at the forward edge, the fenders are held down by easily released clasps located near the cab door.

The doors conceal a "stepwell" on each side of the cab. Two panels on the inner side of the well open into a tool box and the battery compartment. The battery can be serviced through a panel in the cab floor and is easily removed or installed through the stepwell panel.

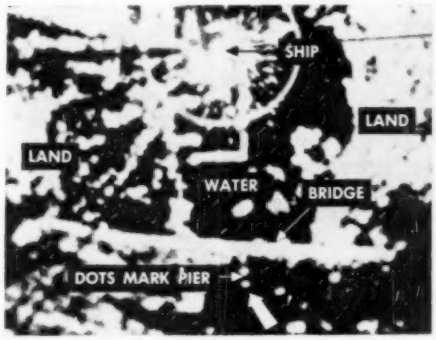
A one-piece curved windshield increases the driver's field of vision.

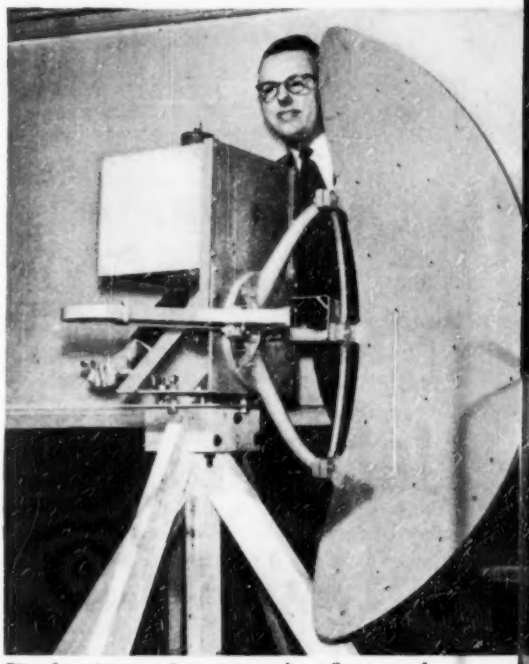


Hinged panel on the dashboard swings down if mechanic must get at one of the electrical gauges. All electrical circuits are individually fused on block in engine compartment.

Radar Spots Bridge Piers

SHIPS navigating fogged-in rivers by radar have one big problem—radar can't spot piers under a bridge because the bridge itself obscures them. Now the Sperry Gyroscope Co. has developed a simple marker beacon that can be placed on any bridge pier to keep ships from ramming it. Bursts of radar energy from a ship are picked up by a reflector, bounced around inside an empty "echo" box, and then sent back to the ship. Since these delayed bursts take longer to reach the ship than ordinary ones, the pier appears to be farther away than the bridge and shows up as dots behind it.

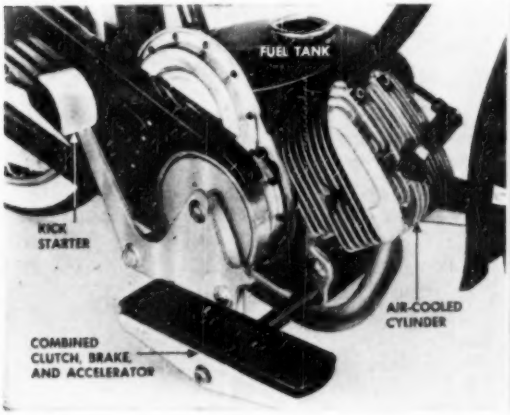


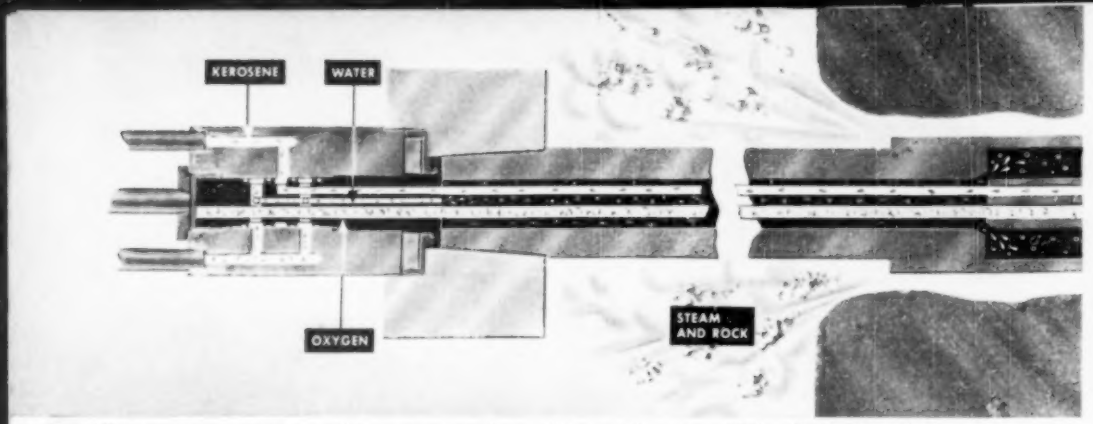


Simple pier marker uses only reflector and "echo" box, needs no power. Radar picture at left shows how dots reveal exact position of pier.

Compact Bike Motor Has Centralized Controls

THIS new Dynacycle motor kit quickly converts any ordinary bicycle into a motorbike. Engine, controls, and fuel tank are grouped in one compact unit that is attached to the bike at the pedal socket, keeping weight and center of gravity low. The brake, accelerator, and automatic clutch are all controlled by a single foot pedal. The 4-hp. engine is said to provide speeds up to 45 m.p.h. and get about 100 miles on a gallon. Made by the Dynacycle Mfg. Co., of St. Louis, the kit sells for $122.50, complete with a 5-inch, automotive-type expanding brake for the rear wheel.





High-pressure oxygen and kerosene are burned to produce two high-velocity jets that can

Jet Drill Gives Rock K.O. Punch

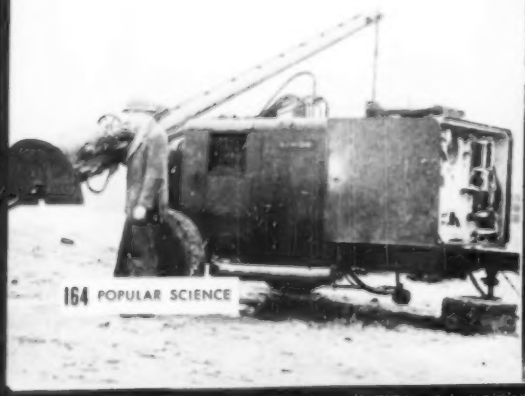
By George H. Waltz, Jr.

A REVOLUTIONARY rock drill, operating on the principle of a fuel-and-oxygen rocket, is punching holes in the taconite fields of Minnesota's Mesabi Iron Range as if it were almost as soft as cheese. Actually, taconite, a low-grade iron ore, is so tough that it quickly dulls the edges of ordinary metal drills. So far, it has defied the efforts of miners using conventional equipment. At best, a high-grade churn drill can sink blast holes in it at not much more than 1½ feet an hour. The rocket drill, however, can eat its way through the hard taconite at better than 18 feet an hour. One Jet-Piercing machine thus can do the work of 12 conventional drilling rigs, a fact that now makes it both practical and economical to tap the last relatively untouched source of iron ore in the United States.

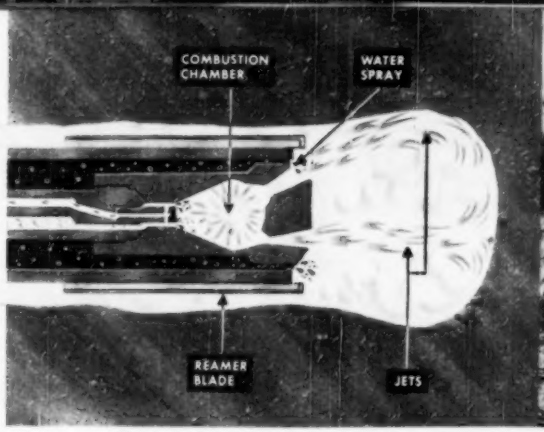
Twin tongues of high-temperature, high-velocity gases, similar to the exhaust blast of a jet or a rocket, do the work that dulls the burrs on ordinary drills. Oxygen and kerosene are fed into a special combustion chamber in the drill head where they burn to produce a violent reaction. The burning gases then are allowed to escape through two holes to form flaming jets that are hot enough to melt steel (about 4,000° F.) and that have a velocity six times that of sound (6,500 feet a second).

In effect, the rocket drill is a supersonic disintegrator. The rock doesn't melt. It has

The portable jet-piercer, which can be towed, has a swivel head so that holes can be made at any angle from vertical to horizontal.



Lighting the jets on the head of the small, portable Jet-Piercing machine that is now undergoing tests. Note the spray of cooling water.



pierce and disintegrate the hardest rock.

Giant rocket drill sinking a vertical blast hole in the tough taconite ore of the Mesabi Iron Range at a rate of 18 feet an hour.

little chance to fuse. It is spalled away in small particles under the impact of the high-velocity gases. Actually, the big machine's cutter pierces rather than drills.

Steam Blows Out Rock

Because it operates under such superheated temperatures, the piercing head must be cooled to keep it from melting. This is done by circulating water under pressure around the combustion chamber and allowing it to spray out of the sides of the piercing head. In piercing, this water spray quickly turns to steam, which serves to blow the disintegrated rock particles out of the hole. To insure a round hole, the whole blowpipe is revolved as it proceeds through the rock. Protruding teeth on the blowpipe knock off any bits of rock that tend to cling in the hole, and the steam blows them out.

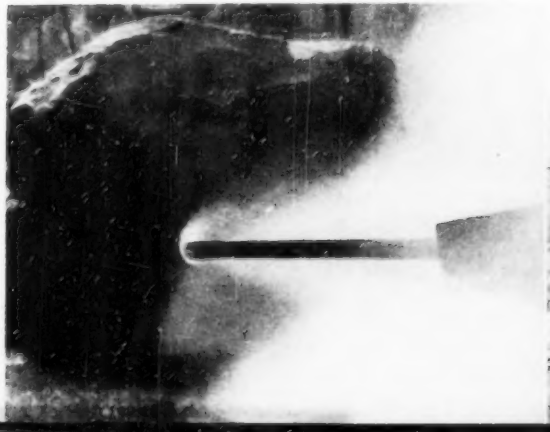
The jet-piercing or rocket drill now being used on the Mesabi Iron Range by the Erie Mining Co. is called the JPM-1 (Jet-Piercing Machine No. 1) by its makers, The Linde Air Products Co. A development of an earlier blowtorch drill (PS, Aug. '47, p. 103), it was designed especially for the job of sinking 30-foot, 6½-inch vertical blasting holes in the low-grade taconite ore.

Self-powered and mounted on tractor treads, the machine can move quickly from one location to another. After a hole is pierced and the blowpipe withdrawn, it takes less than 15 minutes for the big machine to move to the next spot.

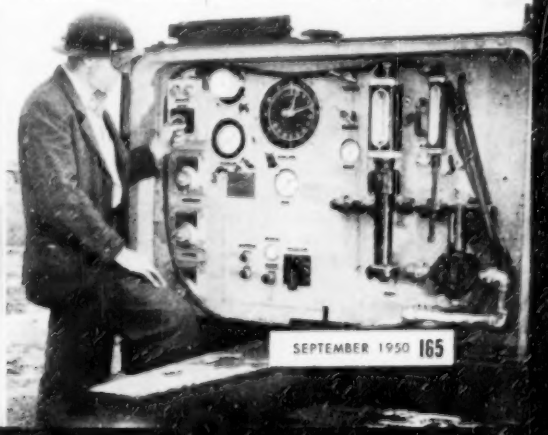
In operation, the big drill uses 10,000 cubic feet of oxygen, 40 gallons of kerosene, and 800 gallons of water an hour. Oxygen and fuel are fed at a pressure of 200 pounds per square inch.

At the moment, a smaller machine, designated as the JPM-2, is being put through its paces in New Jersey. Although operating on exactly the same principle as its larger counterpart, it is portable, can be moved easily from place to place over roads, and has a blowpipe that is pivoted so that blast holes can be sunk at any angle. END

Jet-Piercing machine at work literally eats its way into rock. Water spray quickly turns to steam, which removes rock fragments from hole.

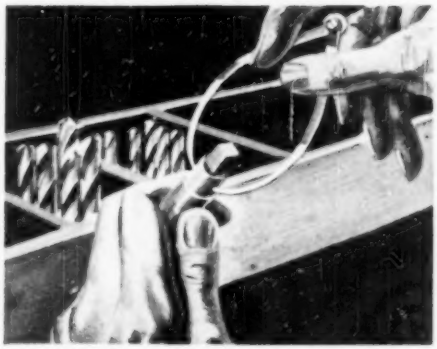


Control panel of the portable machine can be operated by one man. Large black dial in the center shows depth and rate of piercing.



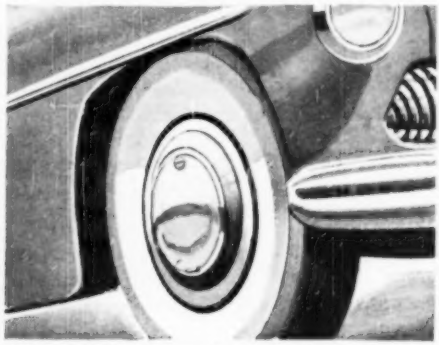
I'd like to see them make . . .

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

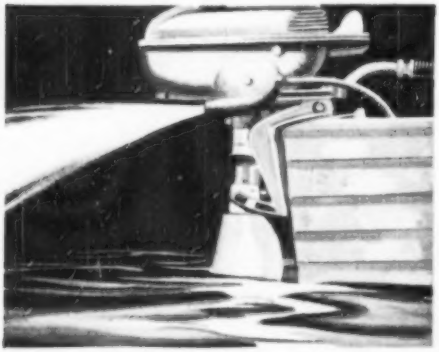


Sized diameters on threading taps. By setting calipers to the tap-drill diameter ground on the tap shank, you could use them to find the right tap drill in a hurry.—*T. W. Cleaveland, Weston, W. Va.*

Snap-on lawn-mower tires. Stretched over the wheels, new rubber tires with tractor treads would improve the traction in tall or wet grass. A little cement would help keep them in place. —*John S. Wozny, Cleveland, Ohio.*



Hub caps hinged to wheels. A chrome fastener opposite the hinge would keep the cap secure and allow easy tire changes. Such mounting would prevent rattling and a lot of lost hub caps.—*Marion L. Rhodes, Knightstown, Ind.*

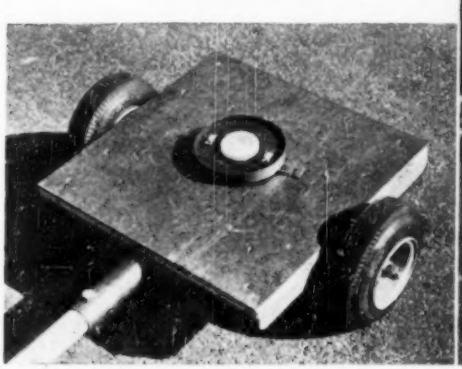


An automatic outboard bailer. A small water pump operating on the motor shaft would save a lot of backbreaking work. A suction hose leading into the bottom would keep the boat constantly dry.—*Archer Wirth, Pelham, N. Y.*

Lag screws with hex heads. You could then turn them in with a socket wrench. This would be much faster and easier than using a regular wrench, and would allow use of a ratchet in tight spots.—*Donald Wolter, Bridgeport, Conn.*

Wheeled "Eye" Checks Lights

An electric eye on wheels now measures dim lighting on streets and highways. The detector, shown in the close-up below, can be towed far enough behind a car (right) to receive over-all street-level illumination, while instruments inside the car make a continuous record. Another version of this new GE device can be carried by hand. Both meters were developed to replace bulky and hard-to-use older types.

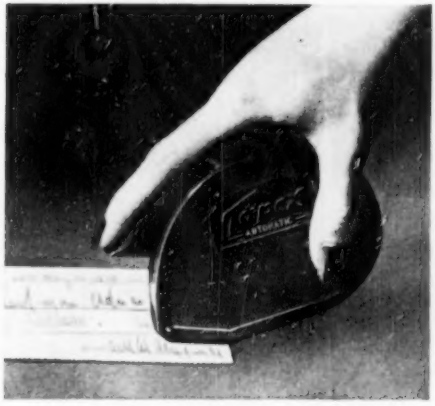


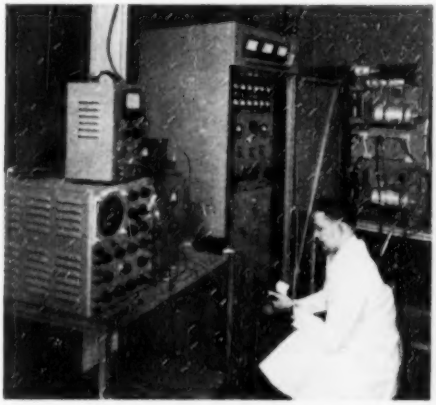
Tape Holder Foils Forgers

The small dispenser below for cellophane tape doubles as a simple check protector. Using the Tapex, you can place tape across the face of a check without touching the sticky part and thus destroying some of the adhesive power. The tape then sticks so tightly a forger would tear the check trying to remove it. The dispenser is made by Tapematic Corp., Newark, N. J., to fit two sizes of tape rolls, and sells for less than $3.

TV Tries New Modulation

A new method of radio transmission is aiding experiments with ultra-high-frequency television. It is phase-to-amplitude (PTA) modulation, which combines two phase-modulated signals to create one amplitude-modulated signal. The transmitter below, developed by Stanford Research Institute for UHF station KM2XAZ, is expected to produce high power more easily than amplitude-modulation equipment.



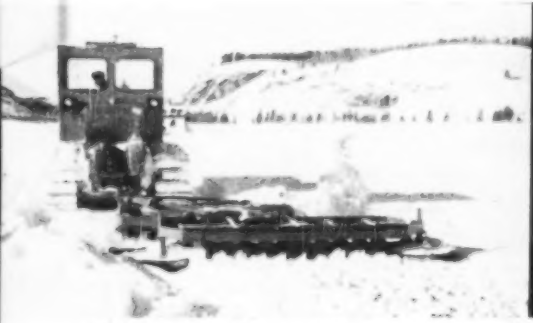


Seabee Snow Packers Make Quick Airfield

Arctic runways may be made of snow—chopped and packed hard by harrow, roller, pontoons.

SOFT snow may become a hard surface for arctic airfield runways after the Seabees get through with it. How it can be done is shown in these pictures of reservists working on a test strip at Camp Hale, Colo.—almost as far from salt water as they could get.

A three-part, tractor-drawn train turns the trick. First a disk harrow chops up the top eight inches of snow. Then a 10-ton roller packs it down. Finally four standard Navy pontoons—they weigh 15,290 pounds—are towed down the line to leave a smooth, compact surface. Light vehicles can travel over the roadway immediately. Within 24 hours the snow becomes harder and more compact as it "settles" naturally. Then it is able to support very great weights, including big planes and trucks.



First step in making an airplane runway or road is pulverizing snow with a disk harrow. Depth of chopping is controlled by large disks at sides, while fineness is varied by changing blade angle.

Eight-foot roller weighing 10 tons comes next. It is made of corrugated pipe of kind ordinarily used for culverts. Free-rolling drum inside is filled with liquid to provide the weight.

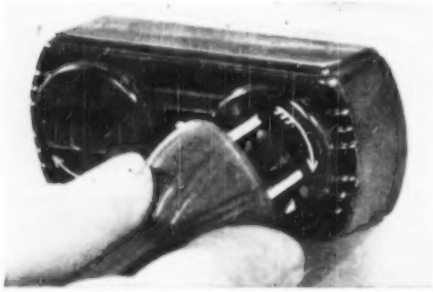
To find out how much weight the finished roadway can support, its hardness is measured with this penetration tester. The tractors on the frame serve merely as weights to hold it down.

Under the tractor-loaded tester frame, this 50-ton hydraulic jack pushes a 30-inch plate down into the snow. Dial measures load on plate, and rulers gauge the depth of penetration.

This is a huge Army wrecker riding on the snow roadway one day after it had been made. With load of 2,200 pounds per wheel, it leaves only a tire imprint on the packed snow. To get a roadway this hard, snow 22 inches deep was compressed to nine inches. This experimental strip, part of Navy test at Camp Hale, Colo., may show quick way to make airfields in arctic.

Samples Predict Runoffs from Mountain Snows

FORECASTING expected water runoff from snow in mountain watersheds is important in making the best use of available water resources. So the men at right, attached to the Nevada Cooperative Snow Surveys, are weighing a hollow tube containing a snow sample on scales suspended from their ski poles. Sectionalized duralumin tubing is used to take vertical core samples at depths down to 20 feet. A steel bit cuts through hard-packed snow. Depth measurement alone is not sufficient, as water content of snow varies a great deal. By making the inside diameter of the tube 1.485 inches, the weight of snow in ounces is equal to the water content in depth of inches.

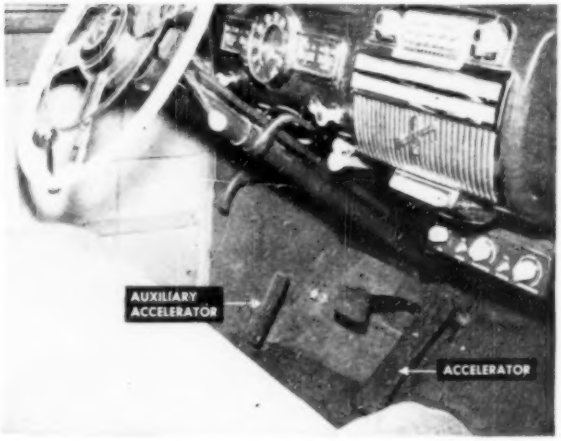


Turn Plug Protects Children

THE plug being inserted in a new safety wall outlet at left can't be pushed all the way in to make electrical contact until it is turned in a clockwise direction. When the plug is withdrawn, a rotating cap on the outlet springs back, sealing off the electrical contacts from probing pins or nails in the hands of small children. Made of plastic by The Bell Electric Co., Chicago, the wall outlets sell for 25¢.

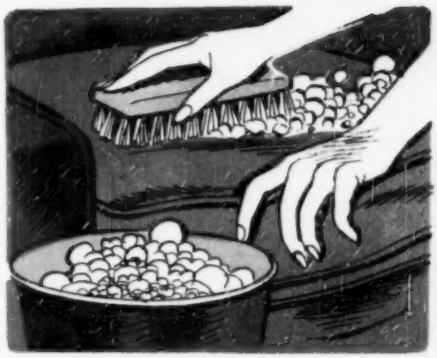
Extra Gas Pedal Rests Tired Feet

EVER feel a need to rest that right foot on long drives? The small pedal at left side of floorboard in photo—an auxiliary accelerator—fills the bill. Marketed by R. V. Lehner, Ness City, Kan., it enables you to step on the gas with either foot. As pictured at right, installed in a clutchless automatic-drive model, the extra pedal fits nicely in place of the absent clutch pedal. In most other types of cars, there is room for it next to the clutch.



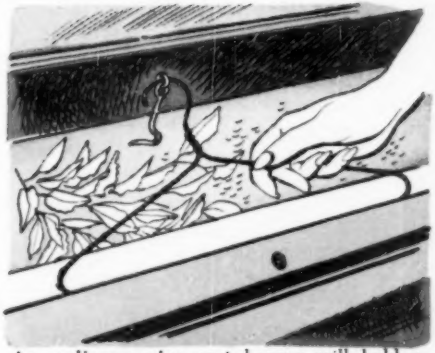
Keeping the Home Shipshape

When the leather of a pocket key case wears out, remove the metal part and mount it on a shelf edge or wall. It's handy for holding various small tools and household keys.

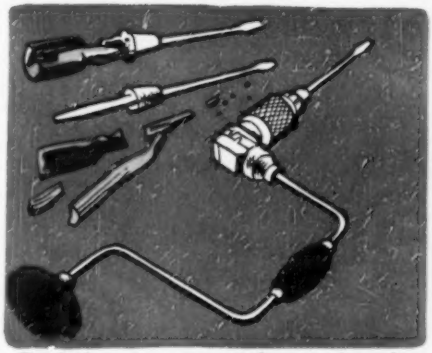


Instead of buying special rug or upholstery shampoo, you can use suds of a detergent soap powder. Whip up plenty of suds and dip the brush in the suds only—not in water.

Cut the top out of an empty salt box and use it along with the threaded rim of a two-part Mason-jar lid. You'll find it makes a convenient dispenser for washing powder.



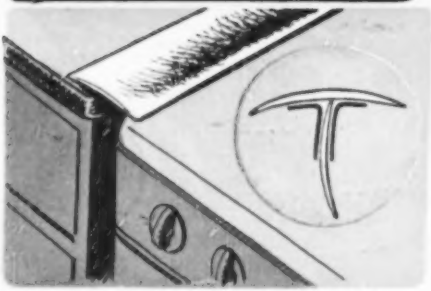
An ordinary wire coat hanger will hold a storm window open for ventilation. Even if a breeze moves the window, the hanger can't fall out. It's hooked through the screw eye.



Don't throw away a screwdriver with a split or broken handle. Remove the rest of the handle and use it as a screwdriver bit. You can chuck the metal shank of the screwdriver in a brace.

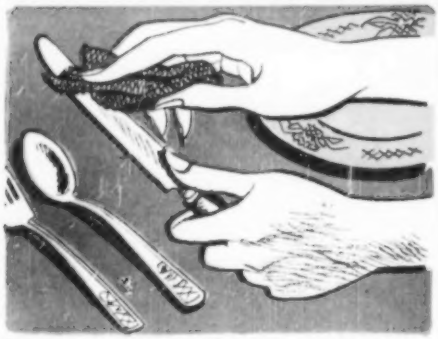
Please turn the page for five more suggestions.

Keeping the Home Shipshape

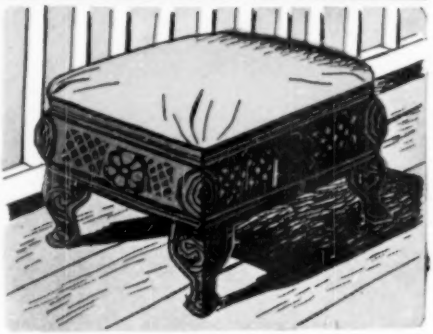


Metal Venetian-blind slats can be used to close narrow spaces between kitchen cabinets. Tape two slats together as shown in the sketch and fit the unit in the open space.

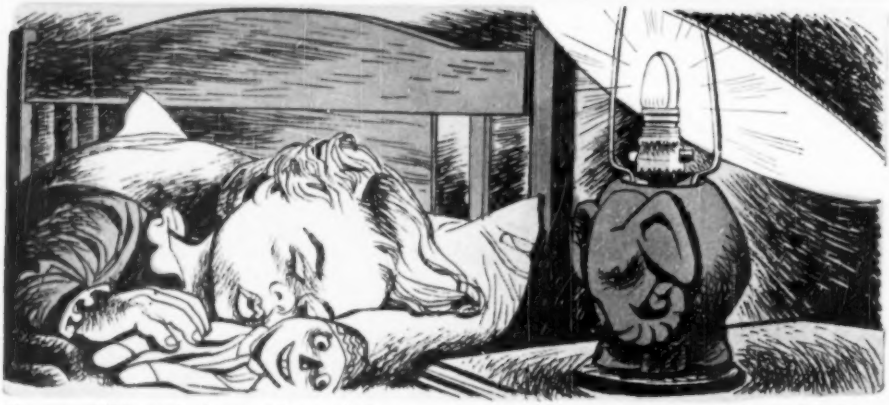
If your heavy pieces of furniture have a tendency to creep backwards until they touch the wall, you can stop it by cutting scraps of lumber into spacer blocks for use as shown.



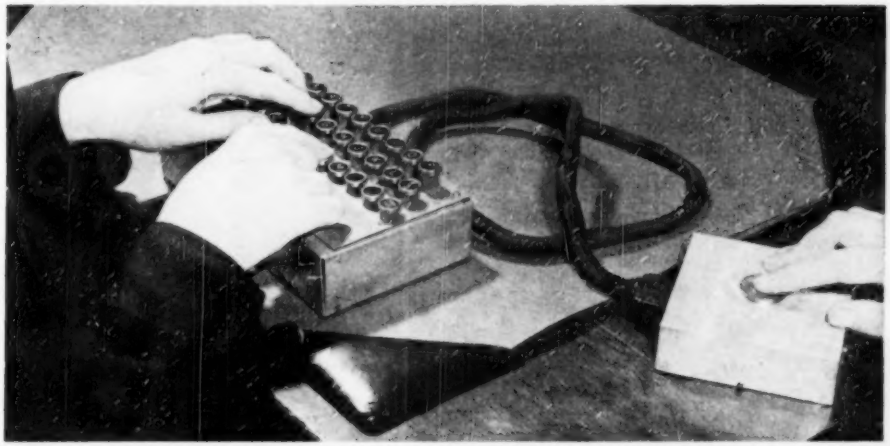
While silverware should be cleaned with silver polish, small stains and tarnished spots can be quickly removed with a chemically impregnated cloth—like blitz cloth.



The bottom part of an old iron parlor stove can be converted into an ottoman for your porch. Use sponge rubber as padding and cover it with cloth or plastic sheeting.



If your child won't sleep without a light, use a plug-in neon glow lamp—the dime-store kind. Screw a receptacle in an ordinary table lamp and snap the glow lamp into it.

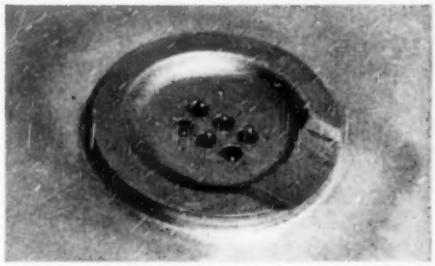


Message tapped out on typewriter-style keys is read by "listener" with finger on receiver.

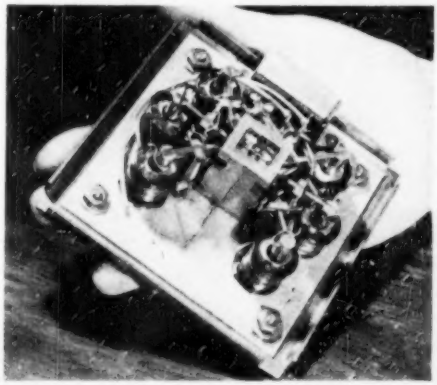
Machine "Talks" to Blind and Deaf

An ingenious new aid, the Electro-Braille Communicator, makes it possible for the first time for anyone to "talk" with a person who is totally blind and deaf. You just tap out a message on its keyboard, arranged in standard typewriter sequence. Six moving pins in a small receiver instantly translate each letter into the corresponding raised character of the Braille alphabet. By holding a finger on the receiver, the "listener" reads the words. If he is able to speak normally, he can thus carry on a conversation. Others can signify, at least, that they have understood a message.

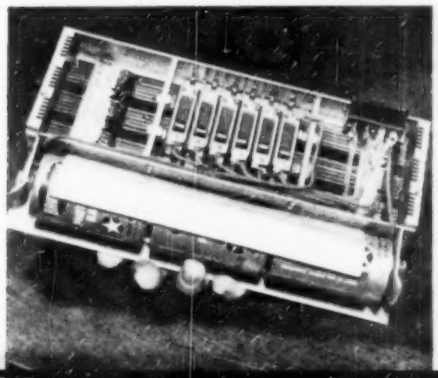
Portable, the five-pound communicator is powered by three flashlight cells. It has been developed by J. O. Kleber, research engineer of the American Foundation for the Blind, New York City. The Foundation plans to have the machines manufactured, and to sell them at cost (expected to be $35 or less) to aid the blind and deaf. END



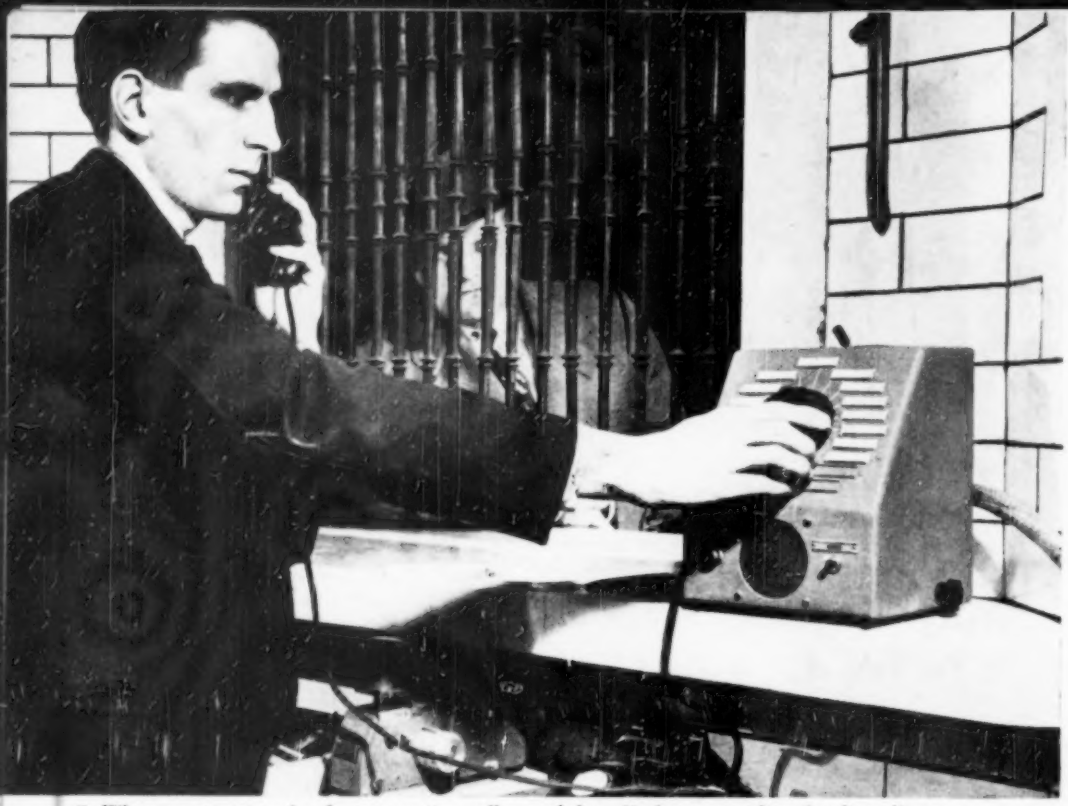
Close-up shows how pins in receiver spell out words in raised symbols familiar to the blind. Position shown is the Braille symbol for "W."



Six solenoids beneath receiver's top, seen detached and turned upside down, actuate moving pins at center through pivoted radial levers.



Bottom view of transmitter shows flashlight cells and six switches that energize solenoids. Notched type bars close switches selectively.



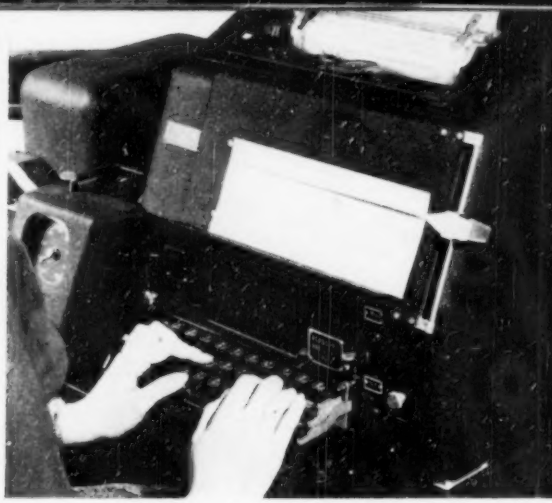
1 **When customer asks** for reservation, all clerk has to do is turn dial to code for train and date. He hears recording that lists all space still unsold, thus knows at once what is available.

Robot Ticket Agent Books Train Space in 45 Seconds

Magnetic recordings that tell ticket sellers what space is available are made by girl at switchboard below. Notified when certain accommodations are sold, she makes new record.

ELECTRONICS is now making train reservations at New York's busy Pennsylvania Station. And the new semi-automatic system gets your space in 45 seconds—the old method sometimes took 45 minutes.

The big saving in time is made by eliminating all direct contact between the ticket seller and the file clerk who actually assigns train space. This clerk now receives teletype requests only for space known to be available, and need not waste time in looking up vacant space and then relaying this information to the ticket seller. The Intelex, developed by International Telephone and Telegraph Corp., is already being used on the Pennsylvania's New York-Chicago trains. By next year it will handle all reservations.



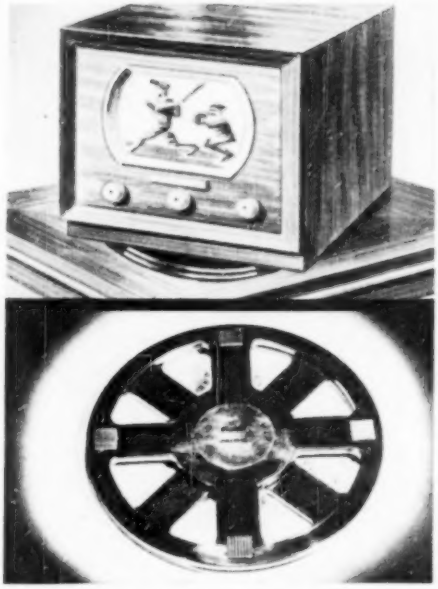
2 Ticket seller's penciled order is then teletyped in code from ticket office to the central file room in the station. Files contain cards, called "diagrams," listing space in each car of train. All assignments of space must be made from diagrams to insure against duplicate sales.

3 Teletyped order automatically makes correct file shoot out of cabinet. Order is also printed on receiving teletypewriter. Clerk, called "distributor," writes order serial number in diagram, then teletypes back to ticket office the space and car number she has assigned.

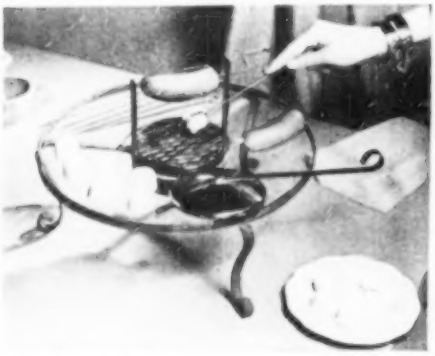
4 The 45-second transaction is finished when the ticket seller gets back completed teletype giving information he needs to write and sell ticket. Typical teletype strip is superimposed on photo above. This one says, in code, that T. P. White wants a duplex room to Chicago on the Broadway Limited leaving New York July 1. "XH W9" at end assigns him duplex H in car W9.

Aids to Modern Living

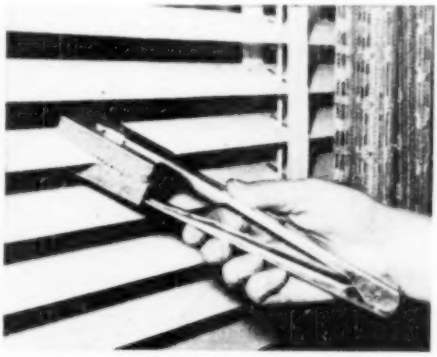
Room Warmer Cooks Foods. When the Hotray Heater is tilted upright, inset, and turned to 350° F., it will cozy up a cold room. Flat, it cooks your breakfast or, when turned down to 200° F., keeps food hot. The radiant glass heating surface is thermostatically controlled. Salton Mfg. Co., N. Y., sells it for about $35.



Turntable Rotates TV Set. The revolving plastic disk above enables you, with a touch of the finger, to turn your table television set to face the viewer, or, in case of built-in antennas, to get the best reception angle. The maker, Turn-Vue Corp., New York, says the $4.95 device also gives needed under-set ventilation.



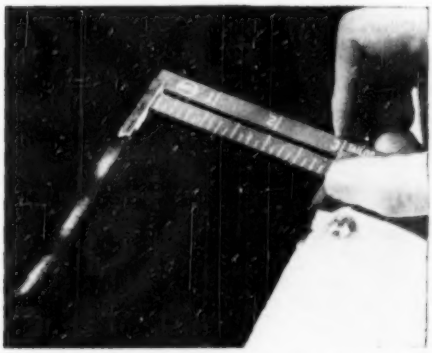
Weenie Is Broiling. And a marshmallow is roasting over the hot flame of this indoor barbecue that stands safely right on your dining-room table. Fuel is denatured alcohol burning in a spun-glass wick. The midget grill has a 14-inch circular glass top held in a wrought-iron frame. Altman, N. Y., sells it for $9.95.



Cleaning Blinds Simplified. To lighten the chore of cleaning Venetian blinds, this gadget holds the slats between the soft cleaning surfaces of its jaw, so they can't slip and slap away from you. It can be used dry for dusting, or wet and soapy for dirt and grime. Spencer Gifts, Atlantic City, N. J., sells it for 59¢.

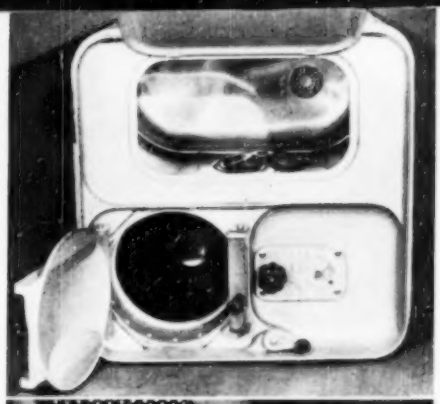
Frame Protects Coffeepot. With a filled glass coffee maker held within this chromium-plated steel frame, you needn't worry about its spilling or tipping at table or while you carry it from place to place. The unit also can be adjusted to hold a small electric stove. Guardex, Portland, Ore., make it to fit 8- and 12-cup sizes.

Kitchen Table Rolls to Work. Ball-bearing casters make it easy to roll this counter from job to job. Part of the hinged top is a cutting board with a slot for scraps to slide into a rustproof can in cabinet below, next to a tall trash can. There's also storage space. Moorex Industries, Richmond, Va., prices Kitch-N-Tainer at $24.95.



Tailoring Ruler Also Marks. With a Tailorette, you can mark off your fabric with tailor's chalk—as you measure—in a one-hand operation. This eliminates the use of marking pins. Made in green, red, or blue plastic, the compact, six-inch marking rule is sold by John Dritz, New York, for 25 cents. Chalk refills sell for 10 cents.

Pressure Cooker Is Safer. The Ekconomic Lo-Pressure Cooker is said to be safer because it uses only 3¾ pounds pressure for most cooking, instead of the usual 5 or 10 pounds. And you can't open the cooker until the pressure drops below ½ pound, because of a locking safety device. Made by Ekco Products, Chicago, Ill.



Tiny Plane Aids Research

TWIN jet engines propel the new Northrop X-4 above, smallest research plane ever built for the Air Force, at high sub-sonic speeds. Resembling big "flying wings" in outline, it has a vertical fin but no horizontal tail surfaces. The X-4 is one of a series of experimental craft, some rocket-propelled, designed purely for research on flight problems rather than for any specific type of military mission.

Washer Easy on Clothes

A TWISTING spiral of soapy bubbles, from a spinning impeller wheel set into the side of a tub, is said to clean clothes with a minimum of wear in the new Prestomat washer. According to the maker, the Monitor Equipment Corp. of New York, six to eight pounds of wash is done in about five minutes. Water pressure on a rubber bag in a rinsing compartment (lower view) then squeezes it damp-dry in one minute.

Trailer Lifts Boat From Water and Puts It Back

A NEW heavy-duty boat trailer lifts a sizable craft from the water, carries it cross-country, and sets it afloat again without need of special ramps or dock facilities. Simply back the trailer into the water, as below, and the boat may be floated on or off special saddles fitting the hull contour. A spring-mounted center cradle is said to hold the hull firm without damaging strains. First of the trailers was built to order for a 13-ton, 46-foot-Chris-Craft, shown below, by the La Crosse Trailer Corp., La Crosse, Wis. It proved so successful that the firm now offers similar trailers to fit any boat of weight and length within limits allowed for highway travel. Savings in transportation and in dock costs, it declares, should soon pay for the trailer.

MECHANICS and HANDICRAFT
REG. U. S. PAT. OFF.

Painter's Secret Is Starting Right

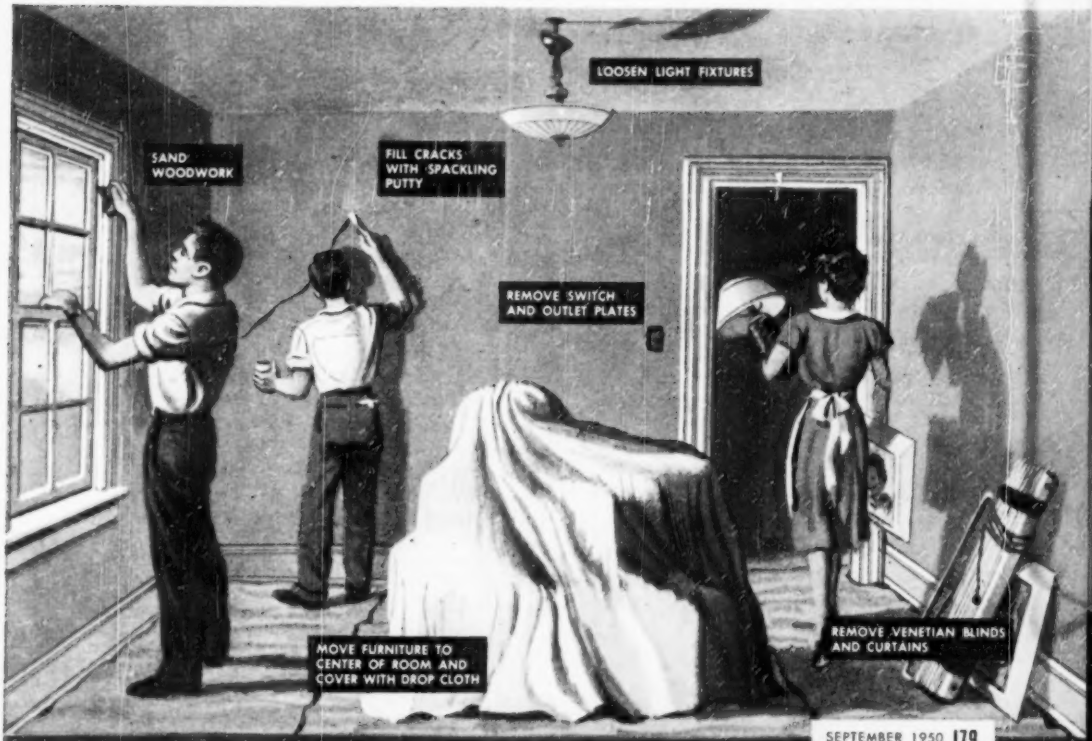
The things you do before you start swinging the brush determine the outcome when you redecorate your home.

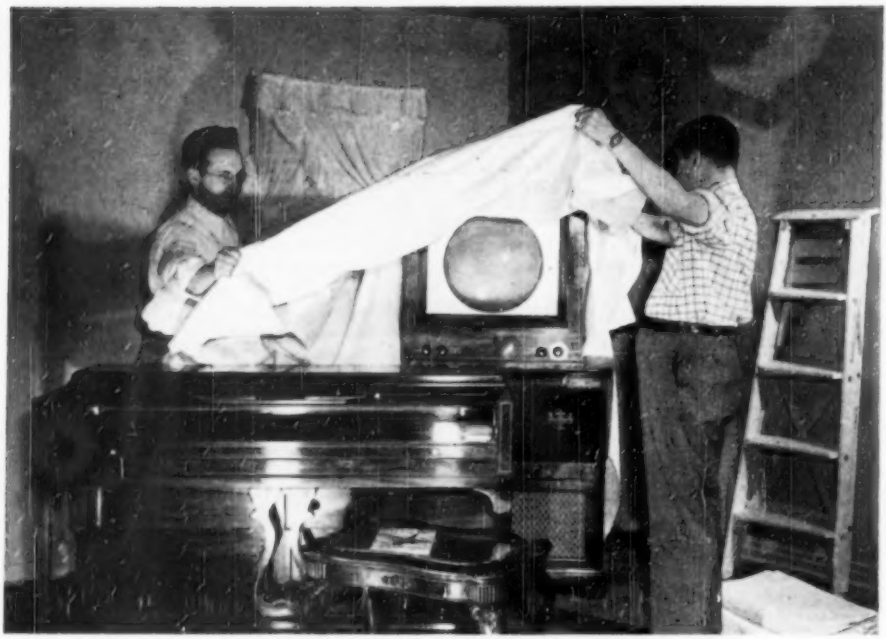
By Bernard Gladstone
Painting instructor, paint dealer, and former contractor

PS PHOTOS BY W. W. MORRIS

LAST month a friend of mine paid $250 to have four rooms of his home repainted. About that time, I did the same job in my home for $40. You can, too, and do it as well as a professional—if you start out right. A fellow just naturally takes a few extra pains when he's working on his own home.

The actual brushing on of the paint is the easiest part. When you get around to doing that, you're on the home stretch. An





If you can't remove all furniture from room, drag the big pieces to center and cover them.

important step—one that a lot of people overlook—is getting together the right tools, materials, and accessories. You'll save yourself headaches and time if you have the right kind of everything you need on hand before you go to work.

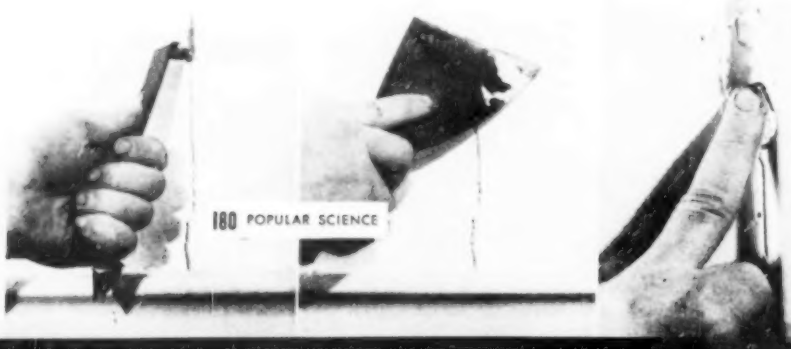
Look at the drawing on the preceding page. Below it is a panel of little sketches showing what's needed for a first-class interior painting job. Be sure you've got all these materials and tools on deck. Then you're ready to start redecorating.

Preparing the room. Move all small objects—such as ash trays, lamps, book ends, vases—out of the room. Carry as much furniture as possible out of the room. Group bulky pieces in the center of the room and cover with a drop cloth. Cover all floor space with drop cloths.

Remove all shades, Venetian blinds, curtains, hangings, and pictures. Loosen electric fixtures so they hang away from the plaster. Remove switch and outlet plates.

Dust and clean all woodwork—and the walls if necessary—and you're ready to go to work. When you paint the kitchen, the walls should be washed down first to remove any grease.

All cracks, even very small ones, should be cut open with a crack scraper (below left). If cracks are wider than ⅛", undercut them to make them wider at bottom than at top. Narrow cracks can be filled with spackling putty (center). Big cracks or holes should first be filled with patching plaster to within ⅛" of surface. When that is dry, finish with putty. You'll find that corner cracks (right) are easier to fill by using your finger to apply spackling putty.



Preliminary steps. Check ceiling and walls for cracks. All cracks, no matter how fine, should be cut open with a crack scraper. This tool has a curved, triangular blade like a beer-can opener. In fact, you can use a beer opener.

After cutting each crack, dust it out and wet it down thoroughly before filling it. Filling is done with spackling putty mixed with water to the consistency of thick cream. Apply the putty with a wide-bladed putty knife, pressing down hard to get a smooth, even finish that'll require a minimum of sanding. Then let the putty harden for about 12 hours and level it off even with the wall, using No. ½ sandpaper.

If you have to put in large patches of plaster, such spots should be treated before they are painted. Otherwise, the new plaster will cause the new paint to dry out streaky and discolored. You can buy commercial sealers for this or you can sponge on a solution made of 1 lb. of zinc sulphate dissolved in ½ gal. of water.

Areas where the paint is peeling or loose should be scraped with your putty knife to remove all the old paint.

Woodwork, too, must be prepared for painting. If the wood has been enameled and is still glossy, this gloss must be dulled before painting. A strong soap solution will usually take care of this and at the same time clean the woodwork for painting. But if this doesn't dull the gloss sufficiently, use a solution of ammonia and water.

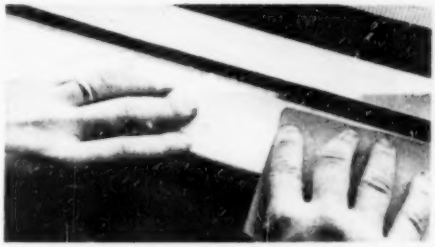
If the woodwork has been waxed, remove the wax with turpentine before painting it. Paint won't stick over wax.

Check the woodwork for holes and cracks, too, and fill them with water-mixed crack filler. Then sand down any rough surfaces with No. ½ paper and finish with No. 2/0.

Painting ceilings. In any interior painting, do the ceiling first. If you want only a little or no change of color and if the old paint is not in too bad a condition, you can probably get by with one coat.

Go over the ceiling first and touch up any bare or patched spots. Then let the spots dry about eight hours before painting the whole ceiling. If there is a decided change in color, or if the old paint was so bad that one coat wouldn't cover it, you should give the ceiling a second coat after the first has dried 12 hours.

Dip the brush in the paint no more than one-quarter the length of the bristles. Tap

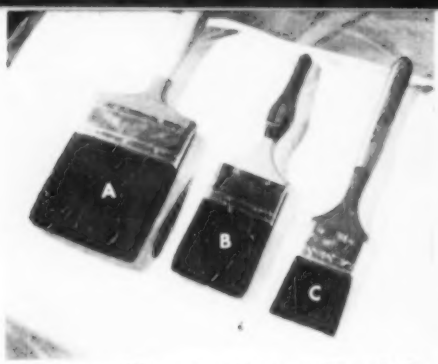


Any rough spots on woodwork should be sanded smooth. Fill all holes and cracks in woodwork with putty and sand smooth when dry.

Two stepladders (only one seen here) and stout plank make scaffold for painting ceiling, eliminating extra steps in moving single ladder.

Start painting your ceiling in a corner. Fill in the corner first and then continue with curving strokes as shown in photo above.

Cut in along trim like this. Turn brush sideways, pull it up to the trim, and draw brush along the joint with a smooth stroke.



Brushes you'll need: (A) 4" to 5" wide for wall and ceiling. (B) 2½" to 3½" for trim. (C) 1" to 2" for window sash. You may like a stipple finish: it removes brush marks from walls. Saturate stipple roller (right) with paint. As you finish each area, run the roller over it.

the brush lightly on the inside of the can to remove excess paint. Then brush on the paint without applying too much pressure. Don't rub hard or brush the paint out as much as you do with exterior paints (PS, June '50, p. 196). Flow it on with curving strokes, keeping the edges wet. This is important, because if any edge is allowed to become even partially dry, it will show up as a lap mark.

This is the reason, too, that you should never stop painting a ceiling or a wall until you come to a corner. Nor should you work all the way along the long side of a ceiling before doubling back for the next stretch. Work back and forth across the shorter width, keeping the edges always wet. On very large, square ceilings, it may be necessary to get a friend to help you with the painting so you can work fast enough to avoid drying edges and lap marks.

Start your strokes by touching the brush to the unpainted portion, curving it into the wet edge, and you'll have fewer lap marks. If too much paint runs down the handle onto your hand, the chances are:

- your brush is a poor one,
- you are thinning your paint too much,
- you are dipping the brush too deeply,
- or you are pressing too hard.

Painting walls. Let the ceiling dry completely before going on to the walls. You may be able to get by with one coat, the same as with the ceiling if the walls are a pastel shade. But if you want one of the deeper, flat shades, then it must be a two-coat job. The first coat will be a clear primer-sealer. Each manufacturer makes a sealer for his particular brand of deep shades. Follow directions for mixing.

Use the sealer to touch up bare or patched areas. Let these dry overnight. Then give the whole wall a coat of sealer. Let this dry 24 hours before applying the finish coat.

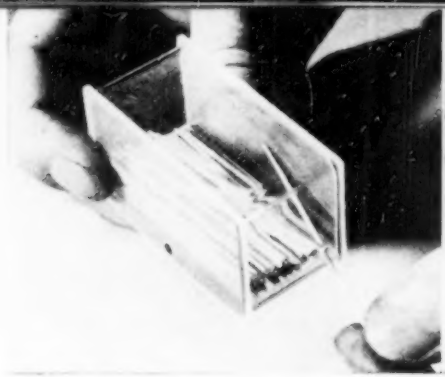
Use only one ladder for wall painting. Start in an upper corner and work down, moving the ladder over for the next stretch. When you come to the woodwork, you'll probably want to use a matching enamel, which gives a harder, more washable finish.

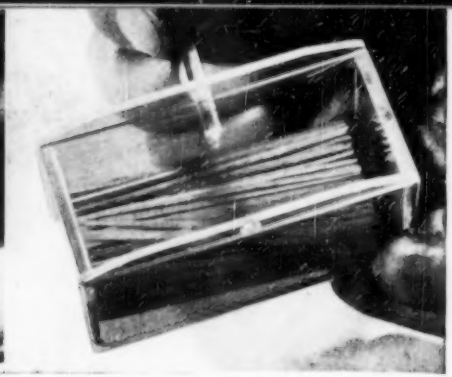
When you've finished your job, it's a good idea to put a little of each kind of paint used in small jars and seal them tightly. Then you'll always have on hand paint for touching up spots that need it. END

The Height of Ingenuity

When I drove into a parking lot, the bumper guards slipped over one of the logs that ringed the lot. I couldn't pull the bumper off by backing up. How do you think I got the bumper free?

I borrowed a shovel and piled up earth behind each wheel. When I backed up, the mounds raised the front of the car and the guards cleared the logs. James S. McNabb, Wellsley, Mass.



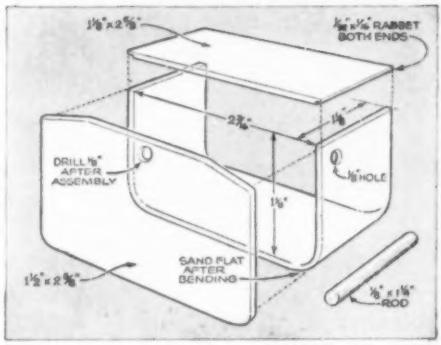


"Toothpick Shaker" Is All Plastic

SHAKING this decorative little plastic box starts a toothpick out the hole (as at left above). Such a box can be made in an evening out of 1/16" acrylic plastic. It will be especially attractive if you use colored or fluorescent sides with a clear body and lid. Black sides with a crystal-clear body are sure to be an attractive combination.

Drill a hole near one corner of a 1⅛" by 4⅝" strip. Heat the strip and bend it around a wooden form, 2 7/16" wide, to shape the body. If you use a strip heater, make two bends to give the same inside measurement. Sand the edges to eliminate any bulge at the bends.

Cut out two sides 1/16" wider than the shaped body, and polish the edges. Then put a little solvent cement (chloroform or ethylene dichloride) into a shallow plate or pan and let one edge of the body soak about a minute. Carefully locate it on one of the sides and weight lightly until the joint sets (about 30 minutes). Cement on the other side the same way.

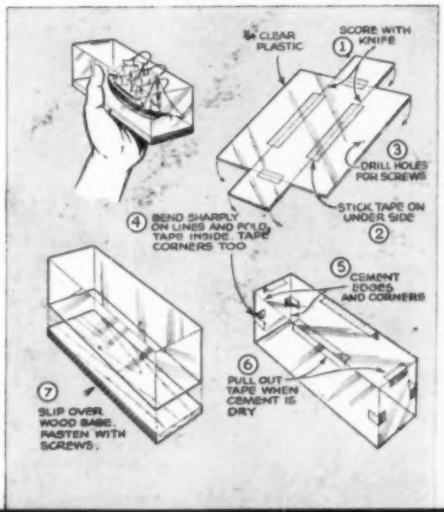


Use slightly thicker (.080") stock for the lid if you have it. Form a rabbet on each end by hand scraping, routing on a drill press or with a hand grinder, or with a shallow cut on a circular saw. Put the lid in place and spot the holes for the retainer, a piece of ⅛" rod. Drill them a trifle low so that the rod springs the lid inward, holding it fast.—*Frank Pars, Washington, D.C.*

Transparent Plastic Cases Display Tiny Models

SMALL display cases for tiny models or other objects are easy to make of thin clear plastic. On 1/64" acetate or acrylic, lay out a pattern as in Fig. 1 at right, dimensioning it for the size of case desired (if necessary, make a trial model of cardboard first). Scribe the bend lines with a sharp knife. Then turn the sheet over and stick cellulose tape along them.

The material will crack on the lines as you bend up the case, but the tape will hold it together. Run a line of cement along the breaks and down the corners. When the cement hardens, remove the tape.—*Ernest F. Hogan, San Francisco.*



Why Argue About Heat?

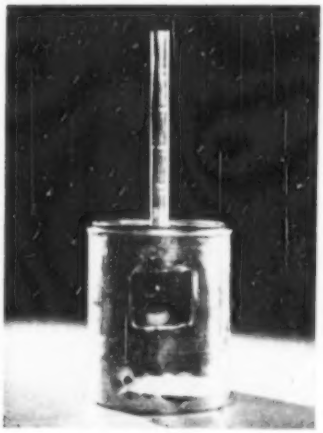
. . . when you can confound the skeptics with these easily performed tin-can experiments.

By Kenneth M. Swezey

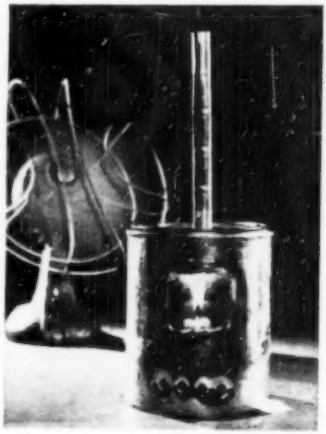
IS IT worth a few dollars to insulate the pipes from your steam or hot-water boiler to the radiators above? Is soot merely a nuisance—or does it secretly sabotage your fuel bills? How do draft controls affect combustion? Do "radiators" really radiate, or do they transmit much of their heat by convection?

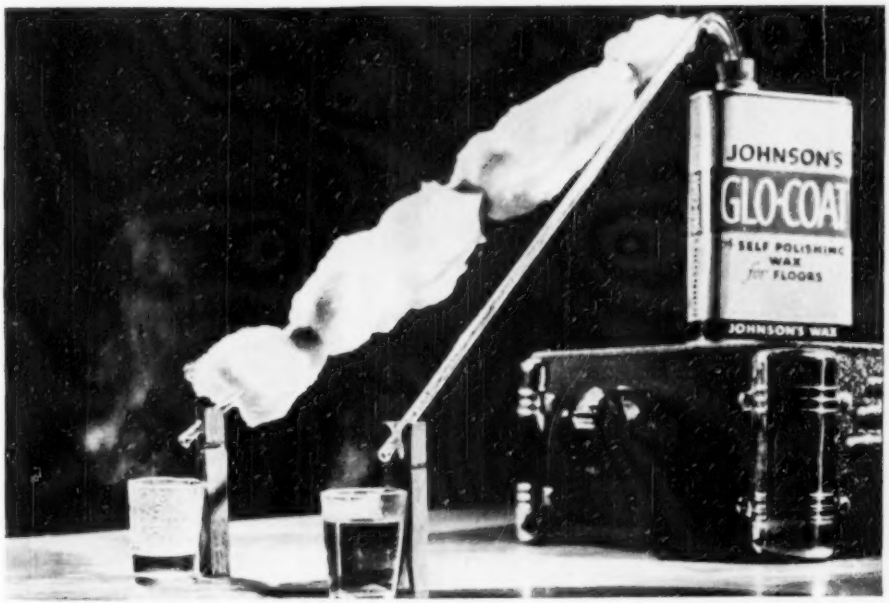
Heating engineers have answers for all these questions. Heat losses from bare or improperly insulated pipes and boilers, they say, may boost your fuel cost 15 to 25 percent. Soot is not only wasted fuel that could have been burned by proper regulation of your furnace, but is also an insulator that prevents heat from reaching the boiler. Ordinary radiators may give off 60 percent of their heat by convection—the circulation of heated air.

If you want to know more about your heating plant, why not investigate for yourself? Results obtained from the simple tests illustrated below and on the following pages—made with tin cans and candles, test tubes and balloons—should be more convincing than even an expert's word.



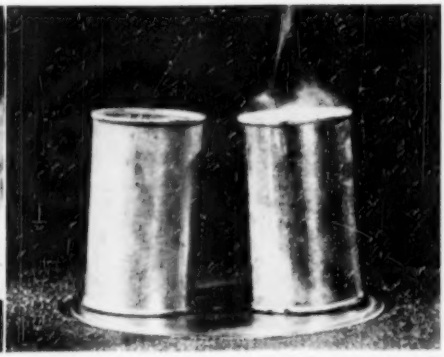
Tin-can furnace (left), with cellophane-covered window and holes near bottom for draft, shows how burning is controlled by circulation of air. If you cover the draft holes, one by one, with tape, the candle flame dims and may go out. Produce a forced draft by letting a fan blow into the holes or over the chimney and the flame will burn furiously, as at right.



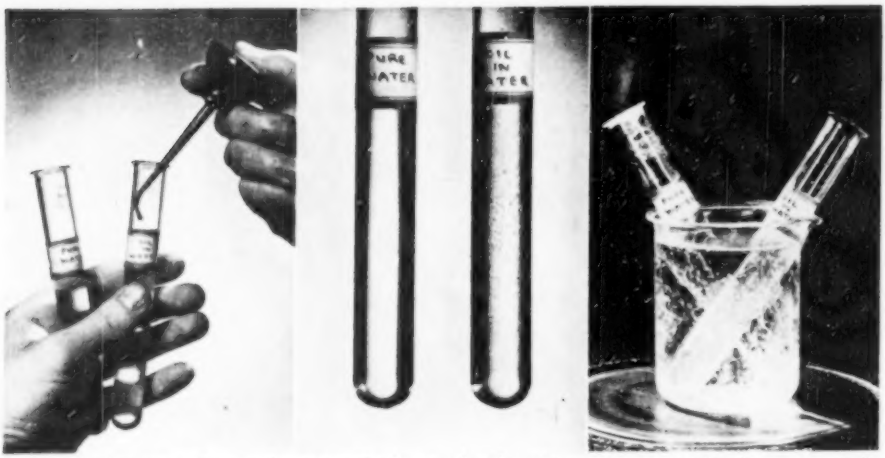


How uninsulated pipes leading from boiler to radiators waste heat is shown by this simple test. Similar glass tubes, one bare, the other covered with cotton, connect with a can of water on an electric stove. When water boils, air around the bare tube cools the steam and changes it to water. Most of the steam going through other tube emerges as steam.

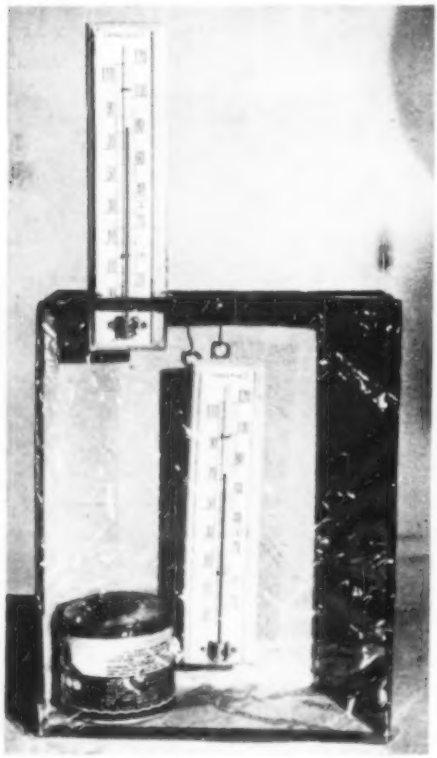
Soot consists of fine particles of carbon produced by incomplete burning. You can prove it is wasted fuel by actually burning it. Smoke up the bottom of a can in a candle flame. Then blow a fine stream of air across the flame with an improvised blowpipe consisting of the partly plugged tip of a medicine dropper connected to a rubber hose. If you direct the resulting hot flame at the can, as at right, the soot will first glow and then disappear.



Soot also wastes fuel by insulating the boiler from the fire, as this test shows. Smoke the bottom of a small can just enough to kill the shine. Put water in a second can and smoke this one until the soot is thick. Now fill both cans with water of the same temperature and put them on a stove. Water in the heavily smoked can will take longer to boil. *[Continued on next page]*

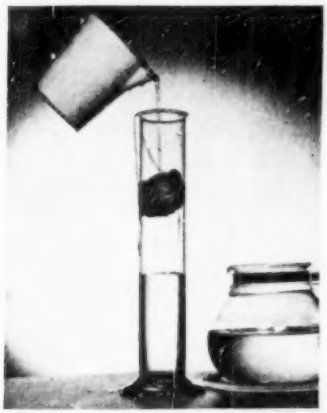


Oil in a boiler cuts efficiency by raising boiling temperature and hindering the formation of steam. You can detect oil and prove its effect on boiling by the steps shown above. Put plain water into two test tubes and add a few drops of oil to one. Shake both tubes. The bubbles that form in pure water quickly disappear. Bubbles in the oily water remain suspended. Stand both tubes in a beaker of water and place the beaker on a stove. You'll discover that the pure water boils more quickly than the oily water, and that it disappears faster.



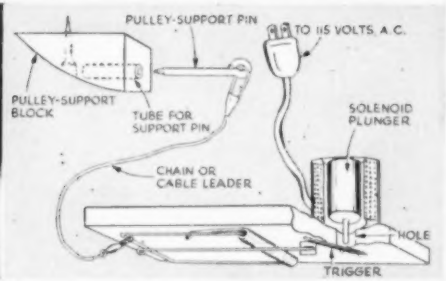
That most radiators transfer much heat by circulation of air rather than by direct radiation can be shown as at left. Put a can of boiling water in a box with two thermometers. Red line creeps up faster on top thermometer, warmed by rising hot air, than on one close to the can.

Metallic paint on a radiator often cuts down efficiency; some ordinary wall paints increase it. Paint one side of a can white and leave the other shiny (to simulate metal paint). Fill the can with boiling water and cup your hands as shown below. The painted side will feel warmer.



How the valve on a steam radiator lets cold air out but confines steam is vividly demonstrated by this stunt. Blow up a balloon slightly smaller than a glass cylinder, and suspend it near the top. If cold water (representing air) is poured into cylinder, it passes the balloon (left). But hot water (steam) expands the balloon and is trapped above it. A bellows holding volatile liquid similarly opens and closes a radiator valve with changes of temperature.

Rattrap Powers Emergency Furnace Shutdown



On windy winter nights I often worried about what might happen in case of a power-line failure. Cold blasts cause the thermostatic control on my furnace to pull the draft wide open. If the electric lines were to be knocked out at such a time, the thermostat would not close the draft again, and the furnace would overheat dangerously.

To set my mind at rest I rigged up this emergency shutdown. Now if furnace power fails, it "fails safe."

I salvaged a 115-volt AC continuous-duty solenoid from a water-control system and mounted it on a rattrap so that the plunger is poised above the trigger of the trap. As long as there is current in the line, the plunger stays up. When current is cut off, the plunger springs the trap.

I improvised the rest of the material to suit my furnace. The shutdown works like this: As the jaw of the trap snaps shut, it jerks a freely fitted pin that supports the draft-door control-chain pulley. This allows the weight of the door to pull itself shut.

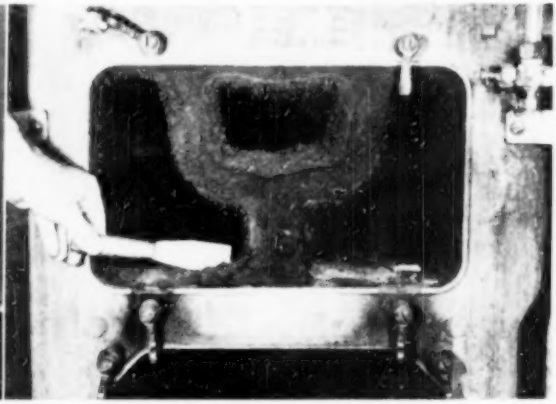
During the summer, or when children are around, I leave the trap unset and substitute an ordinary spike for the pulley-support pin.—*E. F. Lindsley, N. Prairie, Wis.*

Extra Valve Speeds Heating

A steam radiator in an upstairs bathroom or bedroom will heat up more quickly if it is fitted with an extra valve. The second valve can be screwed into the threaded hole which is to be found near the top of most radiators. Normally this hole is sealed with a slotted, removable plug. Two valves bleed cold air from the pipes more rapidly than one. When they're used on an upstairs radiator, they allow steam to rise faster. This helps equalize heat distribution in a house where the thermostat is located downstairs.

Suction does the dirty work. A typewriter table holds vacuum cleaner at a convenient height.

Water-heating operation left my furnace hot, so I allowed it to cool first. Drop-off type doors shown must be held while dogs are turned.



Furlike deposit of soot hanging from heating surfaces was from a year's operation. Insulating effect slows furnace warm-up, wastes oil.

I Cleaned My Furnace With a Vacuum Cleaner

Going over an oil-heating plant is neither messy nor difficult; it took 2 hours, cost 45 cents.

By Robert Hertzberg

"CLEAN the furnace yourself? Not with my nice new vacuum cleaner you don't. Let the oil people do it, and save yourself a lot of mess."

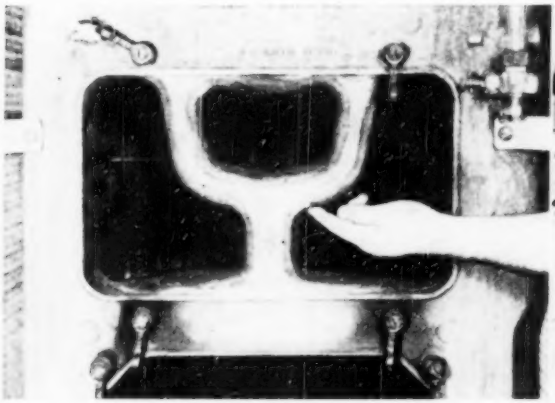
That was my wife's reaction when I announced that I intended to give our heating plant a going over.

"I'm tired of paying 10 dollars or more and then finding soot still left on the boiler surfaces," I said. "Last year the men who did the job were in and gone in half an hour, and I had to tidy up the cellar after them. Had six more to do that day, they said. No wonder they rushed it. But the furnace is the biggest and most important piece of equipment in the house. I want to make sure it starts the heating season in top shape."

My speech convinced me, if not my wife. I went ahead, and can now report that the operation was a success. It took about two hours and cost all of 45 cents. Previously black with a thick fur of soot, the entire fire chamber is now bare and clean, and gets hot in a hurry when the burner goes on.

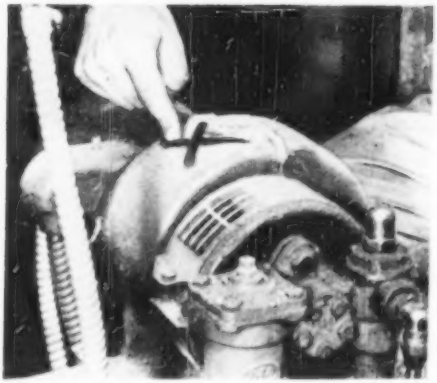
The first radiator on the steam line, in the dining room overhead, becomes warm in the record time of 18 minutes from a cold start. At the end of last winter we

Shut off the switch first of all. Don't trust the thermostat or aquastat. Either one might start the furnace while you're cleaning it.

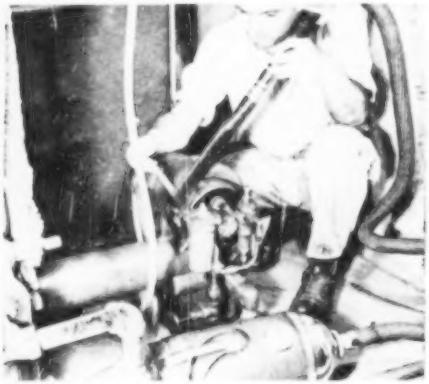


Vacuum removed 80 percent of the soot unassisted. Hard patches were loosened with wire scratch brush, leaving surfaces clean and bare.

The cleaner bag was emptied eleven times. It's a good idea to take down smokepipe and clean it and base of chimney as well as the furnace.



Gun housing and blower head were coated with oily dirt. Removing band gave access to hose that sucked out fluff from the housing.



An old brush helped get sticky dirt from flanges and corners of the housing. Vacuum hose swallowed dirt as soon as it was freed.

Cleaned gun unit is ready for another heating season. Motor was oiled next. Screens in oil-line fittings should be cleaned too.

were lucky to have heat in 35 minutes. What this will mean in more comfort and lowered oil consumption is easy to foresee.

My wife's precious vacuum cleaner, a common tank type, did a fine job and wasn't harmed a bit. After all, dirt is dirt, whether it's from a rug or a furnace. Oil soot looks pretty horrible, but actually it is very light and swooshes into the vacuum nozzle at an amazing rate.

The pictures on these pages show the progress of the soot removal job. My hands and clothes got dirty, just as they do when I work on the car, paint the screens, or weed the garden. Because friends invariably use the word "messy" when we talk about furnace cleaning, I want to say emphatically that it is *not* messy at all. Poking around with the vacuum nozzle and a wire scratch brush will, of course, raise clouds of dust inside the furnace, but the cleaner sucks them up rapidly. What it misses tends to be drawn up the chimney by its natural draft.

I may forget appointments with my dentist, wedding anniversaries, and the third payment on my income tax. But I didn't overlook the obvious precaution of shutting off the burner at the switch—not merely at the thermostat—before going near the furnace. It's a good way to keep your eyebrows from getting singed.

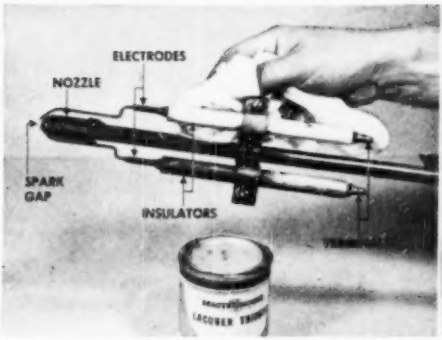
Vacuum Eats Oily Dust

Looking over the gun burner, I saw that the motor, pump, blower, and transformer were covered with a thick layer of oily dust. This disappeared quickly into the vacuum cleaner. Investigating further, I discovered that only a single screw held the nozzle and electrode assembly inside the blower tube that fits into the fire box. After removing this screw and loosening a union at the oil pump, I extracted the assembly easily.

Its appearance scared me; it was coated with a thick layer of black, gummy goo. The stuff didn't respond to turpentine, that old reliable, so I phoned a neighbor—a teacher of chemistry—for advice. He had a quick answer.

"Acetone is what you need. It'll wash that gunk away like magic. But if you ask for acetone in a local hardware or paint store, all you'll probably get is a blank look. Try a drugstore. If you can't get acetone, buy ordinary lacquer thinner at a paint shop."

That's how I spent the 45 cents—for a pint of thinner, of which I used only four



Business end of burner was removed, the high-voltage wires unsnapped, and insulators wiped with lacquer thinner, care being taken not to bend the electrodes or change the spark gap.

Nozzle was unscrewed with a wrench, and with its filter immersed in several changes of thinner, the first shown above. When solvent stayed clear, nozzle was allowed to dry, then replaced.

ounces. My son is using the rest for thinning model-airplane dope.

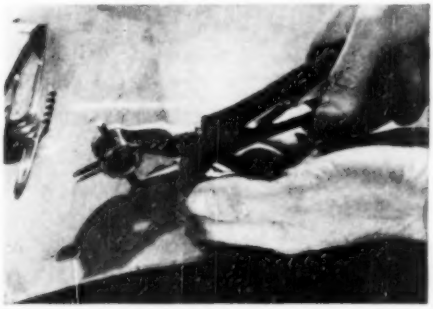
I cleaned the electrodes and insulators with a rag dipped in the thinner. Then I unscrewed the nozzle from the end of the feed pipe and discovered that it had a built-in filter screen, almost completely blocked with sludge. Dunking the whole nozzle in thinner for about three minutes made it bright and shiny.

An oil-burner nozzle is often compared with the carburetor of an automobile, but there is nothing delicate about it and it has no adjustments of any kind. It is merely a threaded brass cap with a very small hole through which the fuel oil vaporizes as it is pushed through by the pump. What you *must not* do is poke a wire or needle into this hole to clean it, for that may enlarge it and cause trouble. Just soak it, and screw it back securely, and you'll be all right. It's not even necessary to wipe it dry, for the solvent evaporates rapidly by itself.

"Well, was it worth the trouble?" my wife asked when I returned the vacuum cleaner—thoroughly cleaned out, of course.

"It was no trouble, and it was plenty worth while," I answered. "The furnace is really clean, and I can keep it that way by vacuuming it every six months. It'll take only an hour and we'll save money on oil. Speaking of money, by the way, I'm crediting myself with 10 dollars. Need some new tools for the shop . . ." END

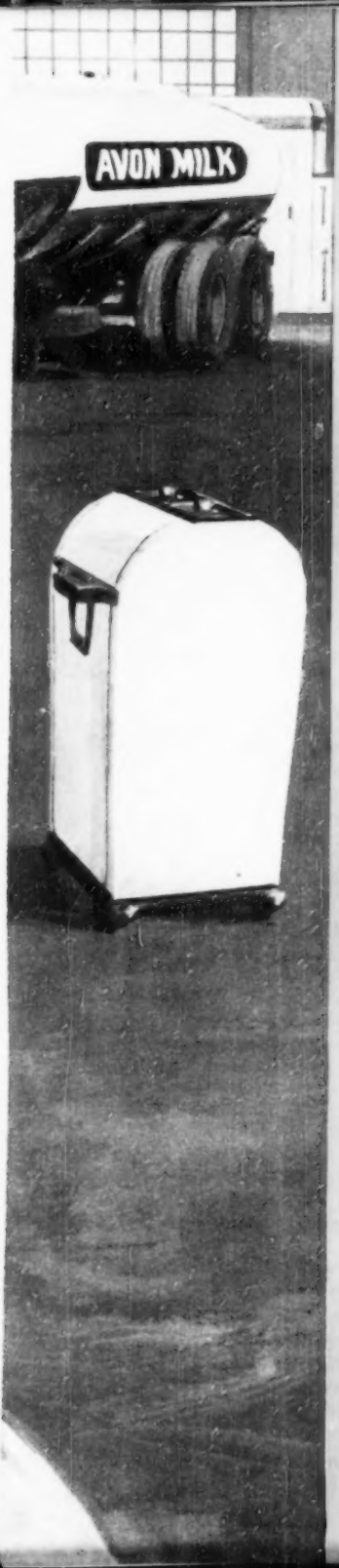
Keeping Leather from Tearing



When you are working with leather, it's best to punch a small hole at the point where two cuts are to meet at right angles. A plain right-angle cut is likely to tear, but a radius distributes the stresses and reduces the likelihood that a rip will develop at this point.

They're welders. To prevent distortion of the work from the intense but localized heat, the speaker first joined the workpieces by short welds before running the main beads.

AVON
AVON
AVON
RAY QUIGLEY



Gus and the Gas-Hungry Milk Trucks

When a friend in the milk business brings his headaches to the Model Garage, Gus takes on the job of trouble-shooter—and scores a bull's-eye.

By Martin Bunn

GUS Wilson perched himself up on his repair bench, thumbed some shreds of tobacco into the bowl of his pipe, and looked at a completely empty shop floor. It was the first time since June that there hadn't been at least three cars stacked up in the Model Garage for some kind of repair. It had been a particularly busy summer, but at the moment Gus was enjoying the pleasant feeling of having nothing pressing to do.

His dream of leisure, however, was short-lived. Through the puffs of smoke that billowed up as he fired his pipe he noticed that Ed Nealy's car had rolled to a stop in front of the shop doors. Ed, one of Gus's really old friends, owns the milk company down in the city. He started out in a small way about 20 years ago, but now he services our town as well as a dozen other communities. He hasn't been getting to town much during recent years, but whenever he does, his trip includes a stop at the Model Garage.

"Ed Nealy, how come you're out touring the country on a work day?" Gus greeted him as the two shook hands. "Playing hookey from those milk routes of yours?"

"No such luck, Gus," Nealy replied. "Believe it or not, this is strictly a business call."

"Something wrong with the car?" Gus asked as the two strolled back into the shop.

"No, car's okay. It's something more important than

As Gus strolled across the milk company garage, a voice greeted him. He turned and recognized Jack MacDonald, the Avon day-service foreman.

that. Can we go into the office and talk?"

"Sure thing," said Gus, leading the way.

"Gus, I've got a favor to ask," Nealy began when they had settled themselves at Joe Clark's battered oak desk. "How would you like to take on a consulting job down at my plant? I'm sure it wouldn't take you more than a couple of days, and you can charge me whatever you think your time is worth. I've got a problem and I think you can lick it for me."

"Now hold on, Ed," Gus put in, "I'm just a small-town garageman. I may be able to tell when a gasoline engine has gone sour, but when it comes to milk it's been a good many years since I was a farm boy."

"That's just why I want you to help me," Nealy explained. "I do know the milk business, but I don't know the first thing about engines. And there's lots of gasoline mixed up in the milk business. To pick up my milk and distribute it every day I have a fleet of 42 trucks. About half of them roll during the day, the other half at night, so to keep them in shape I run the service department on two shifts.

Night Trucks versus Day Trucks

"I've got a good foreman heading up each service crew," Nealy went on. "John MacDonald on the day side and Ned Pocheck at night. You know them both. Good, reliable men."

Gus nodded. He remembered them as local boys who'd taken jobs in the city, and wondered if Jack MacDonald was still as cocky as he used to be.

"Well, for about two years now," Nealy continued, "the night trucks serviced by MacDonald's crew have cost me more to operate, mile for mile, than Pocheck's day trucks. Last year, thinking that a little friendly competition might help, I even offered a semi-annual cash bonus to the crew that kept their maintenance costs the lower for each six-month period. It didn't help. So far, Pocheck's crew has won both bonuses."

"You sure of your cost figures?" asked Gus.

"Absolutely. The whole operation is cost-accounted every month, and invariably the day trucks get much better gasoline and tire mileage than the night trucks."

Gus thoughtfully scratched his chin with his thumb. "And you want me to play private eye and snoop out the leak?"

"That's it," said Nealy, "but don't get me wrong. I'm not asking you to do a sneak snooping job. No one's going to get fired. All I'd like you to do is spend some time with the service boys down at the plant, check over our maintenance procedures, and tell me what, if anything, we're doing wrong. How about it?"

Gus Takes On the Job

Gus didn't answer immediately. Then he said, "Well, Ed, I'm not so sure I can help you, but I'm willing to take a try. I guess Stan Hicks and Joe Clark can keep the garage from falling apart for a few days."

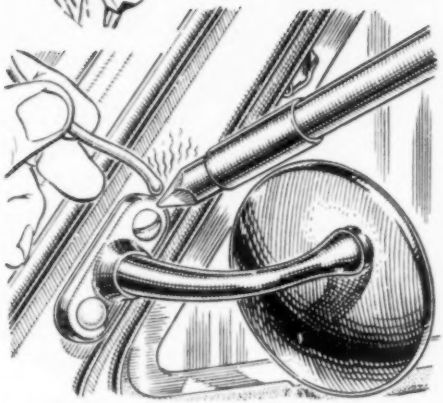
"It's a deal then," said Nealy, beaming. "I hoped you wouldn't let me down. I'll have everything ready—and you don't know how much I appreciate this, Gus."

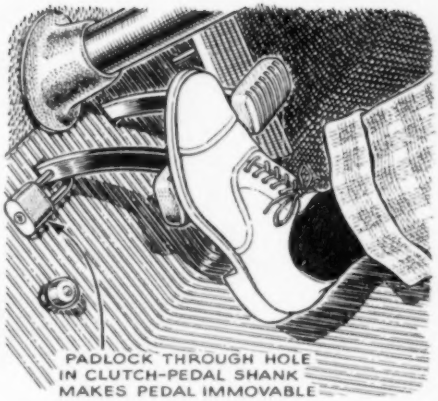
Two days later Gus found himself in a new role. Instead of tinkering with ailing carburetors, ignition systems, and fuel pumps, he was sitting uncomfortably at an office desk going over volumes of records. Gus never has liked offices, records, or desks, but he knew that his first job was to check the facts and figures. What he found was just as Ed had outlined it. For some unknown reason, the day trucks were getting better gasoline mileage than the night trucks and the tires on the night trucks were wearing out about 20 percent faster than those on the day trucks.

With the pencil work out of the way by the end of his first day, Gus put on a pair of coveralls the next morning. Unfortunately he hadn't remembered to bring a pair of his own, so he had to wear a pair Ed Nealy gave him—a white pair with the words, "Avon

[*Continued on page 244*]

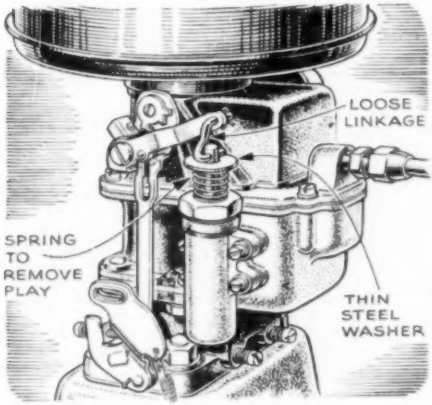
Hints from the Model Garage

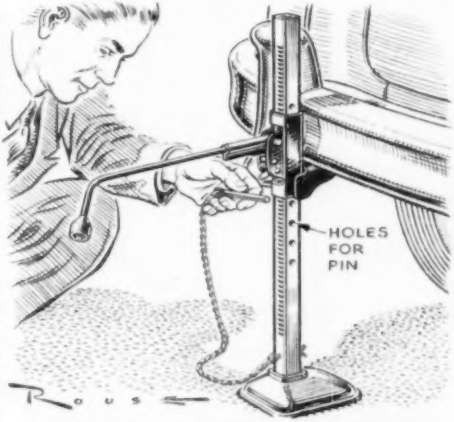




Two Ways to Foil Thieves. Accessories screwed to your car's exterior can be protected by filling the screw slots with solder. If you find ordinary solder hard to handle, try the liquid type. This might be gouged out, but it will discourage a thief, since doing it would make him conspicuous.

Locking the clutch pedal is an effective way of protecting a standard-transmission car. Without the clutch the car can't be driven, and there's no easy way to saw off the lock if you drill the hole near the floor.



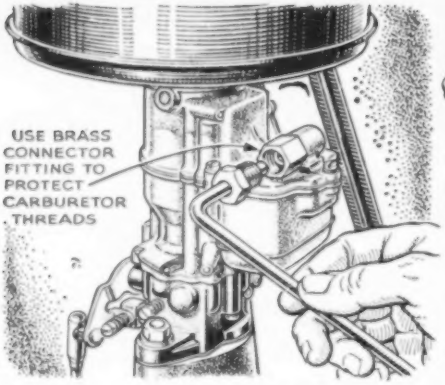


Spring Helps Pickup. In older cars there's sometimes a slight delay before the engine responds to pressure on the accelerator. This results from wear in the linkage between the accelerating-pump lever and push rod. A coil spring and washer installed on the push rod as shown will take up the slack in the linkage.

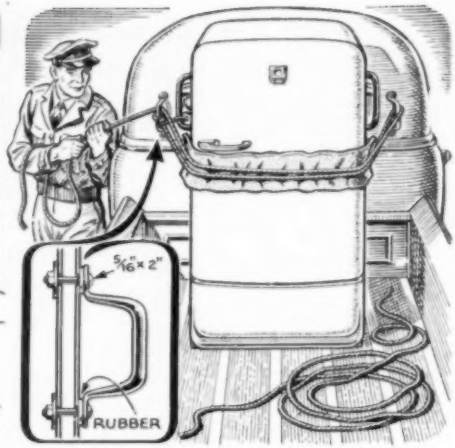
Pin Makes Jack Safer. Drill several small holes through the shaft of your bumper jack. Then, after the car has been raised to the desired height, put a steel pin through the hole under the ratchet mechanism. If the mechanism slips, the pin will keep the car from falling. The pin can be chained to the jack.

Turn the page, please, for four more auto hints.

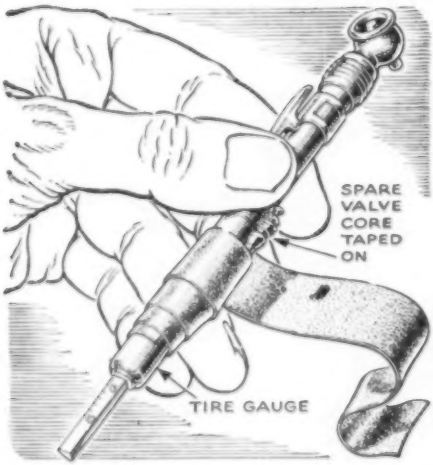
MORE Hints from the Model Garage



Connector Saves Carburetor. On most cars, a brass connector screws on the carburetor body, and the gas line in turn fits into the connector. If this brass fitting is missing from your car, installing one now may save you the cost of a carburetor later. A new one might be the only way out if a mechanic should strip the threads in the carburetor body while trying to connect the fuel line directly.



Tying Down Your Cargo. After a refrigerator had fallen from his pickup truck, Howard Butt, of Pocahontas, Va., decided it was time to stop such accidents. He bought some of the chromium handles designed to help a driver climb to his seat in a cab-over-engine truck and attached them to his truck as shown above. They made excellent tie-downs for lashing on the load.

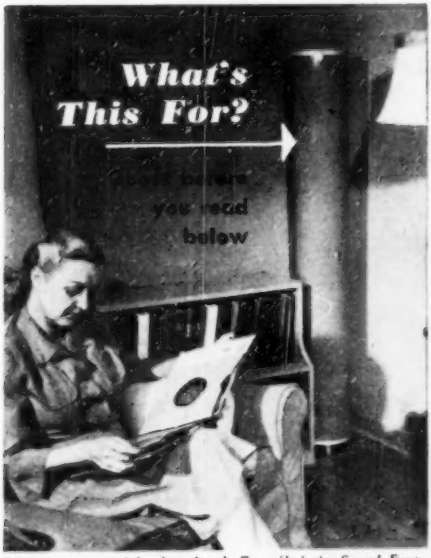


Keep Valve Core Handy. Place a new tire-valve core against the body of your tire gauge and wrap tape around it. The core may come in handy sometime if you find a leaking valve while checking your tire pressures.

Screen Catches Bugs. Insects wedged within a radiator core may reduce its cooling efficiency. To keep them out, Richard C. Schneeloch, of Tulsa, Okla., suggests placing window screening between the core and grille. Clean it off occasionally.

Ratchet Improves Driver Grip

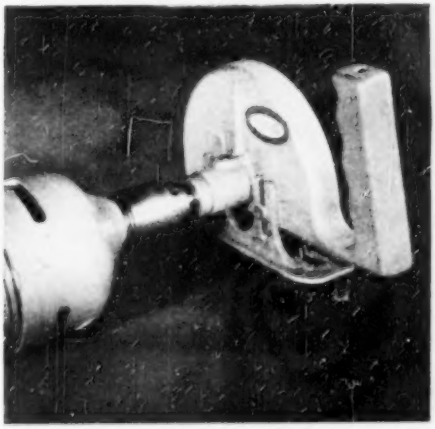
THE palm-fitting screwdriver handle at left above provides the extra torque you often need for driving or loosening stubborn screws. A square lug on the reversible ratchet handle fits a ⅜" socket in the head of the screwdriver. Kipton Industries, Kipton, Ohio, makes the ratchet and various matching drivers. The handle sells for $2.95 and screwdrivers are priced from $1.05. The palm-grip ratchet may also be used on standard ⅜" wrench sockets.



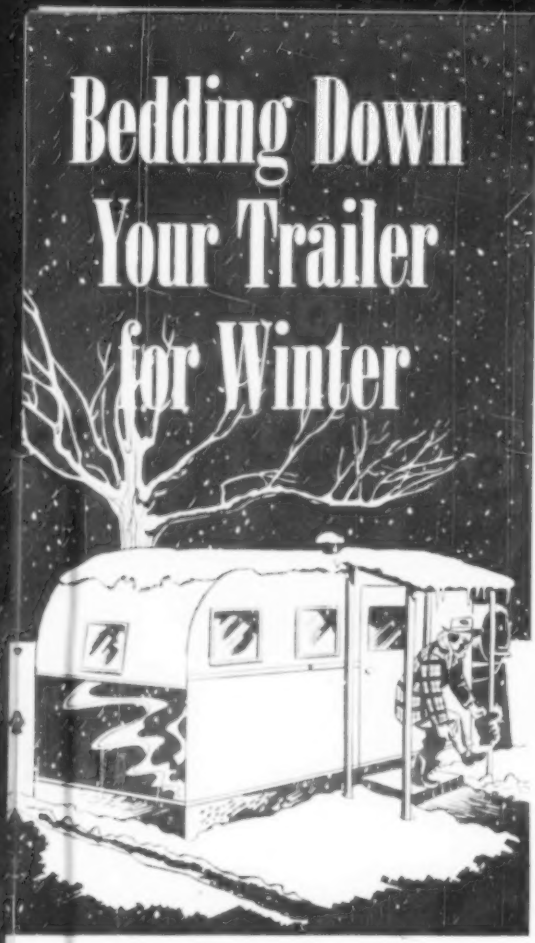
It's a new type of loudspeaker baffle called the Sound Fountain. The large tube in the corner of the room has an 8" speaker built into the top. The long cylinder is said to give even sound diffusion over larger areas than conventional baffles. There's no conflict with decor, say the makers, for the tube can be painted or papered to match the room.

Drill Drives Small Saws

You can now turn your ¼" electric drill into a small circular saw. Two of the new attachments designed to do the job are pictured here. The direct-drive model below, made by Federal Engineering Co., New York, sells for $6.95. The one above, a product of Drill-Sawmatic Co., Chicago, uses bevel gears so that the drill is behind and in the same plane as the cut. It retails for a dollar more. Both saws have 1-to-1 ratios, depth-of-cut adjustments, and maximum cuts of 1⅝" with 4" blades.



Bedding Down Your Trailer for Winter



By John J. Flanagan
(Who has lived in a trailer two winters.)

WILLINGLY or not, a lot of trailerites spend the winter where the thermometer dips below zero. If you're among them, a little work will increase your comfort, decrease your worries, and save you money.

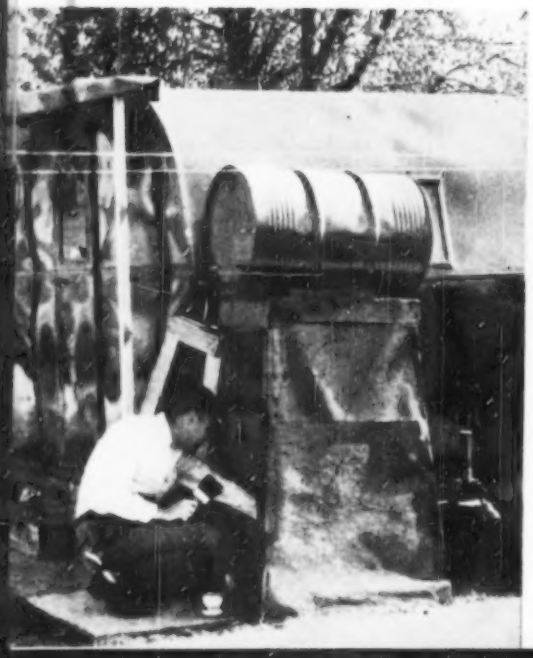
Select your site carefully. Avoid low ground and refuse any spot you suspect may be a dirt fill. Dig a drainage ditch away from the site and park the trailer over its beginning.

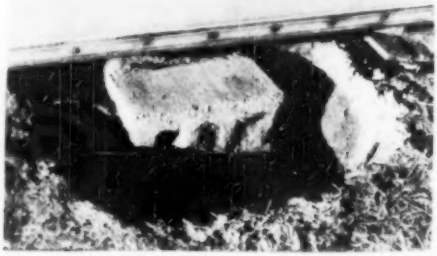
Set trailer on a foundation. Ask the weather bureau the depth of the local frost line and sink your foundation below this. Remove and store the wheels. To prevent winds from whistling underneath, put panels under the trailer as shown on the next page.

Install a gravity fuel system. Build a rack that will hold your oil barrel higher than your stove. Plug the small opening in the drum with a cut-off valve fitted to receive ¼" or ⅜" copper tubing. Run the tubing under the trailer, looping it in several places to take care of expansion. Drill a hole through the trailer floor below the stove, push up your tubing, and connect it to the control valve.

It's a good idea to build a rack large enough to take two drums side by side. Attach a cut-off valve to each and join the lines at a **tee.** Then, when one drum is empty, you can draw from the other.

Protect water pipe from freezing. Be sure to lay the main supply pipe below





Set it on a foundation that reaches below the frost line. This will keep trailer firm, even though ground surface heaves as it thaws and freezes.

Let gravity feed oil to your heater. Set drum high on a frame like this, enclose sides, and you've got useful storage space. Note door shelter too.

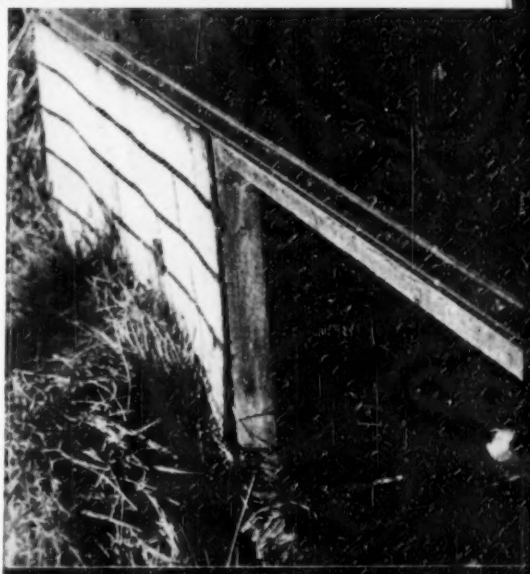
the frost line. Where it enters the trailer the cheapest protection consists of alternate layers of paper and rags. More effective insulation can be obtained by wrapping the pipe this way and then packing sawdust, excelsior, rock wool, or manure in a box built around it.

For a fancier job, you can order a wire heating element through a trailer-parts company. This wire, wrapped around the pipe and plugged into an electric outlet, will give enough warmth to keep the water flowing in the coldest weather. It takes the same amount of juice as a 30-watt bulb —no large operating cost compared to replacing a burst pipe.

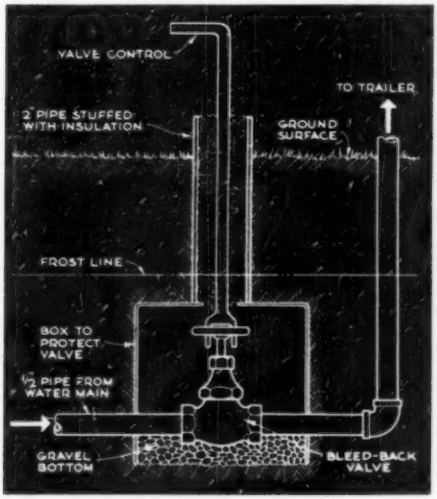
Install a valve to shut off water. If you may be away from home for long periods, put a shut-off valve below the frost line. Get a valve with a bleed-back action. This allows the water on the faucet side to flow out after the valve has been closed.

Insulate the windows. As in any home, your windows should have "storm sash." From a hardware store buy several yards of transparent plastic glazing and insulating material. Cut pieces a little larger than your windows and tape them in place inside the trailer.

An enclosed vestibule outside the door will do a lot toward keeping the trailer comfortably warm. But you can build a less expensive substitute by sinking four posts in the ground to support a projecting roof. END

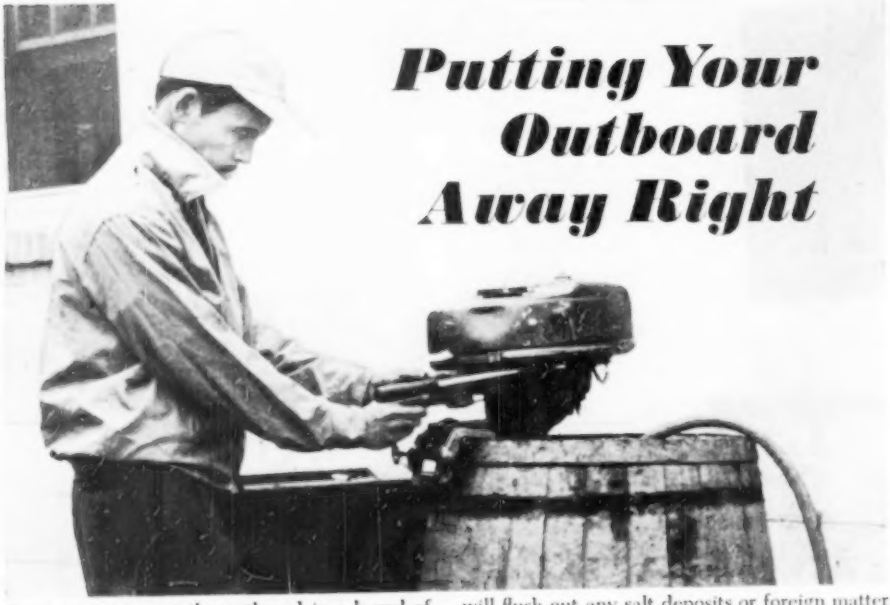


Enclose space between trailer and ground and your floor will be warmer. For this, make panels by covering wood frame with doubled tar paper, roofing, or other available material.



Insulate water pipe by wrapping with several layers of cloth and paper, right. Better yet, run pipe through trailer floor and box insulation around it, above. For long absences, install a shut-off valve.

Putting Your Outboard Away Right



First step is to put the outboard in a barrel of fresh water and run it for a quarter hour. This will flush out any salt deposits or foreign matter picked up while it was used in shallow water.

By Thomas Wm. Helm

IF YOUR kicker has come through a season nicely, you naturally expect it to be ready to go next spring. But you may be wrong, unless you store it right.

Many an outboard turns balky after a winter of idleness. Draining the gas tank and laying the motor on a garage shelf isn't good storage. The smart thing is to take time in the fall to bed it down right. Then it'll roar to life at the first yank when the next boating season begins.

Careless storage can do more harm than regular use. Dust, gum, rust, and corrosion get in their licks twenty-four hours a day. Loose bolts allow gaskets to become dry and brittle. Water left in the cooling system may rust parts until they must be replaced. Fuel dregs can gum up gas lines and carburetor jets. Dry pistons may freeze up in time. In short, neglect is inviting trouble.

But all these woes can be prevented. Follow the simple maintenance steps in the photos. They chart an easy course to happy boating next spring.

Drain the tank really well. Then wash it out with about a pint of unleaded (white) gasoline. Drain again, and let it dry out, with the cap left off, until all the gas fumes are gone.

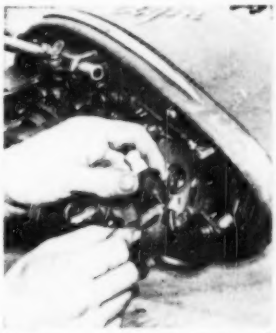
Remove propeller and inspect it for bad nicks or bent blades. Nicks can be smoothed by careful filing, but a bent propeller ought to be sent back to the factory for straightening.

Slip gear out, wipe the shaft, and check it for noticeable wear points. These may indicate a bent shaft. Better have it straightened before spring.

Wash old grease off the gears and out of the housing with white gasoline. An old paint brush helps to do the job by getting into tight corners.

Repack with grease as recommended for your motor. Turn flywheel to work grease well into gears. Now is a good time to replace cover gasket.

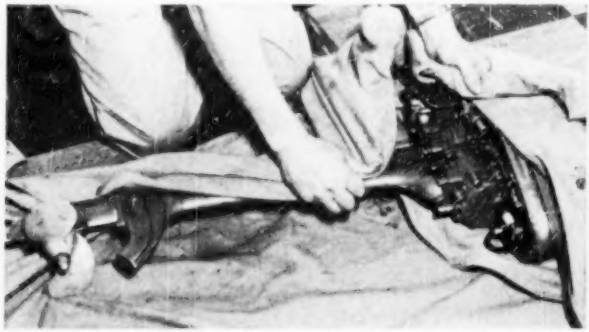
Open and clean the carburetor of all gum and sludge, using white gasoline as a solvent. Inspect the unit for loose screws and leaky gaskets.



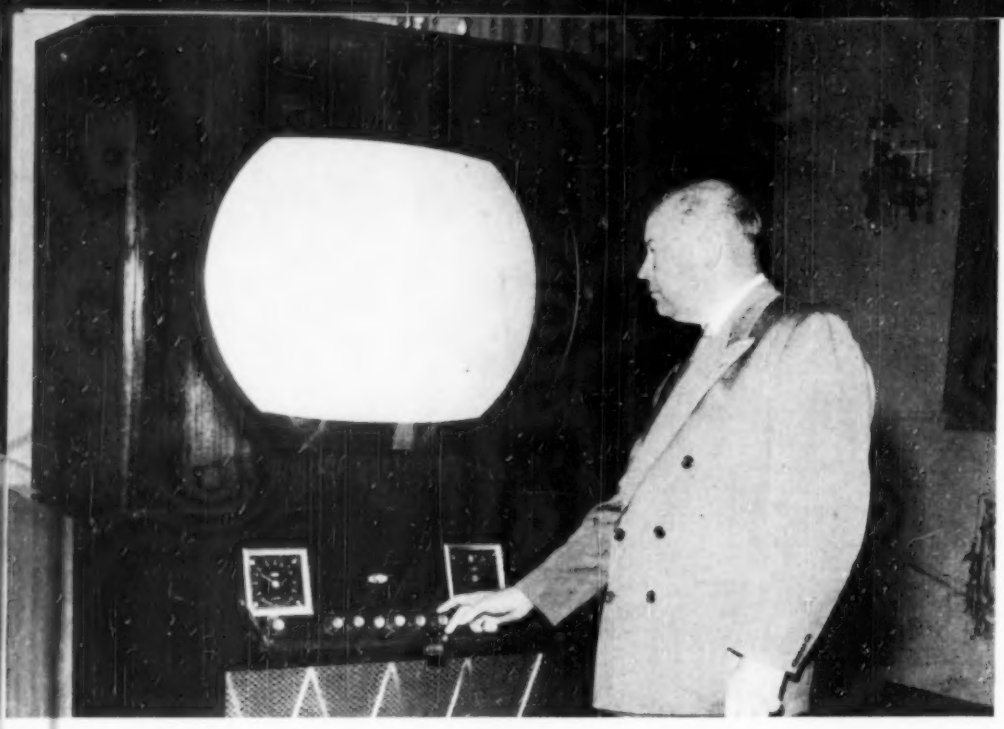
Remove sparkplug, scrape off carbon, inspect electrodes for wear, and regap to the recommended setting. Wipe the porcelain and terminal clean.

Put about half an ounce of light lubricating oil in the cylinder. Rotate the flywheel until the piston is thoroughly oiled to prevent freeze-up.

Inspect wiring for cracked or abraded insulation. Clean such spots and bind them with tape. Terminal ends at the magneto or plug are most vulnerable.



Finally, give the motor an over-all wiping with solvent or gas, let it dry, and wrap it in clean canvas or heavy kraft paper. This will keep out moisture and dust. All you'll have to do next spring is fill the tank and spin the flywheel. Your outboard will be ready to go when you are. END



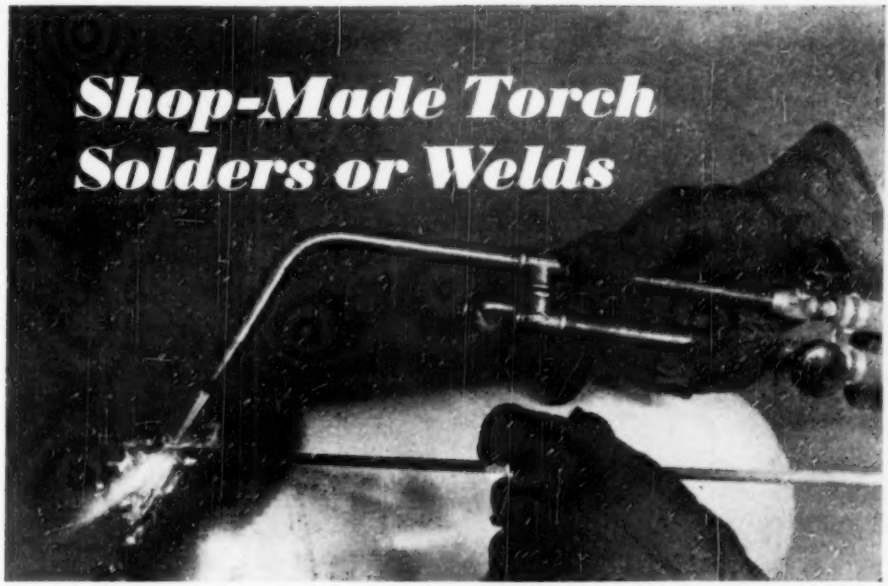
TV Tubes Get Bigger...

Larger TV screens are featured in most current telesets, with 14- to 19-inch tubes getting the biggest play. General Electric promises a 24-inch set for this fall, and Du Mont is showing the giant 30-incher above. It's the largest direct-view set to date, has 536 square inch picture area, and is suitable for restaurants, clubs, schools, and other public places.

...And Tuners Cross the Room

Big tubes mean greater viewing distances. Some new sets provide for your comfort by allowing you to change programs from your easy chair. The Philco remote-control system, below and at the right, selects channels and adjusts sound and picture. The Zenith unit, at right below, changes stations. It's optional on all new Zenith sets, may be added later if desired.

Shop-Made Torch Solders or Welds



A three-way mixer on this torch burns acetylene with oxygen, air, or a mixture of the two.

The right temperature for any job from lead burning to welding steel can be yours at the twist of the valves.

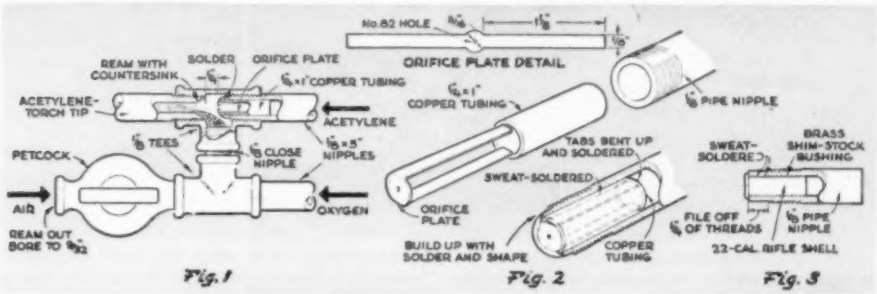
By Don Pittwood

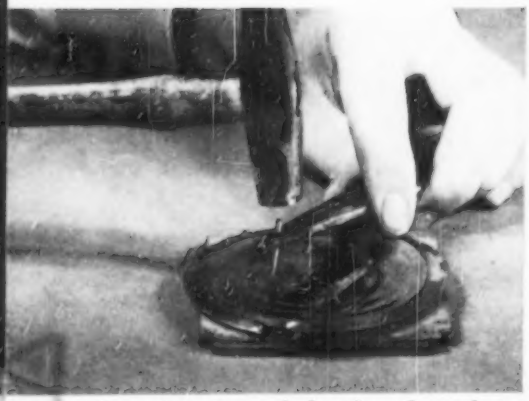
HERE'S one torch that will do almost any heating job from soldering right up to heavy welding. You can use it with a small acetylene tank for light work or hook it to an oxyacetylene supply for heavy going. All you change is the tip.

By using plain air for the low-temperature jobs, the torch saves costly oxygen, and the heat can be kept below the danger point at which light work might be burned. With good valves it can even be adjusted to burn a mixture of oxygen and air with the acetylene, giving in-between temperatures.

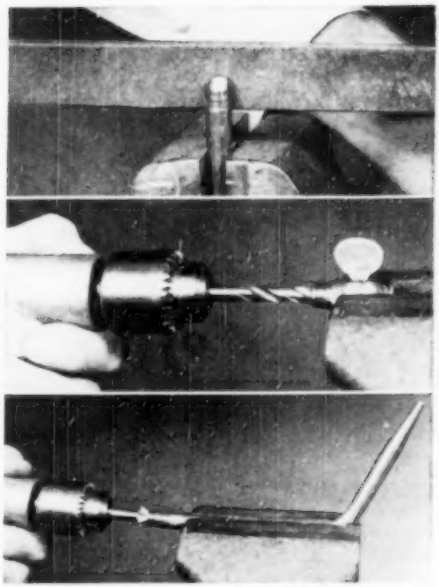
The secret lies in a two-way aspirator feeding oxygen from the back, while air is drawn in from the front by the velocity of the acetylene jet. This assembly is made of two ¼" pipe tees joined with a close nipple and fitted with two 5" long nipples on which the gas valves are screwed. I used two small needle valves from an old gasoline camp stove, but any gas-tight valves that give good flow control will do.

At the front of the lower tee goes the air valve. I used a petcock with a comparatively large core for this, as the through passage must be at least 9/32" to admit enough air. Turning the core to the open





Gas orifice is punched with a sharp phonograph needle in tin-can stock or sheet brass.



After the orifice strip is soldered into the copper tubing, solder that into the pipe nipple, flow solder around, and file smooth, as at top. Air valve is made from a petcock by drilling through 9/32" (center photo above). Tip for burning air or air-oxygen mixture is drilled out to 3/32" at the orifice end and reamed with a countersink at the other.

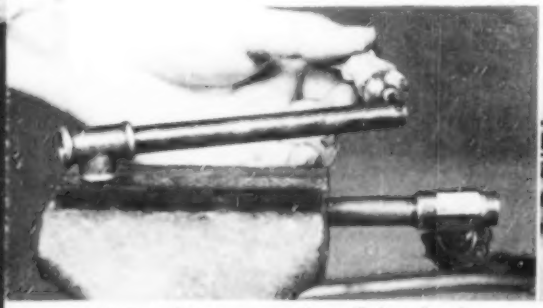
position, I ran a 9/32" drill clean through, took out the core to scrape off drill burrs, and reassembled the valve.

Perhaps the most critical part is the orifice through which acetylene is admitted. I made it by punching a hole through a can lid with a phonograph needle. You might prefer to use thin sheet brass. The orifice should be a bit smaller than a No. 80 drill. If it's bigger, it will pass too much acetylene for the amount of air drawn in; if too small, it may take too much acetylene pressure to get enough gas through.

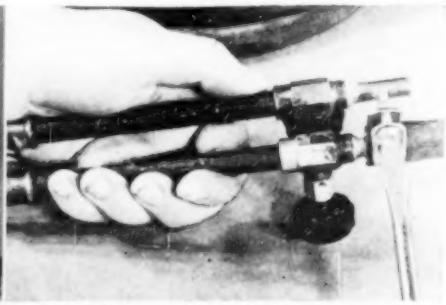
The orifice strip is bent U-shaped as shown in Fig. 2, with the punch flare out, and sweat-soldered into a 1" length of copper tubing. Bend the tabs over the end of the tubing to help secure them. Then solder the tubing into the 5" pipe nipple, build up the stepped end with solder, and file to a rounded shape.

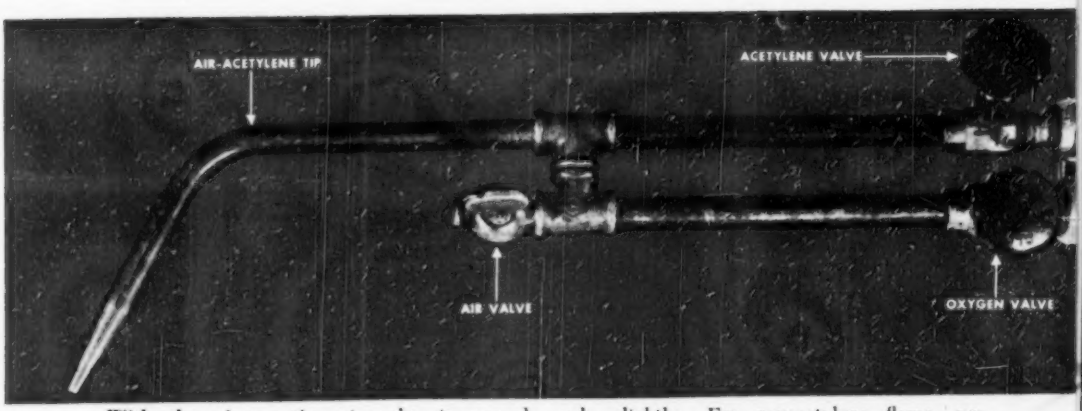
Another way of making the orifice is shown in Fig. 3. Wrap an empty .22-cal. cartridge shell with a bit of brass shim stock to make it a push fit in the long pipe nipple, clean out the inside of the latter well, coat with solder, and sweat-solder the shell with its wrapper into the bore. Punch the orifice in the end of the shell from inside, so that the flare of the hole is out.

Standard oxyacetylene tips can be used in



Smear pipe compound on all threads when assembling the torch. Turn valve handles slightly away from each other for easy operation. Attach both gas hoses with clamps, as above.





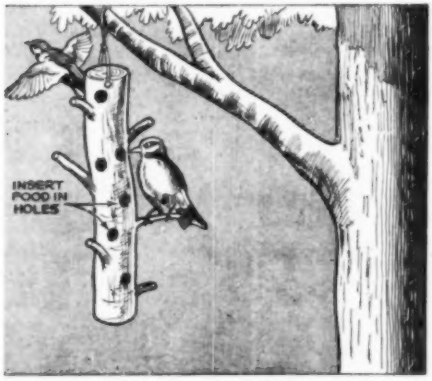
With the air-gas tip, air valve is opened and oxygen valve closed entirely or opened only slightly. For oxyacetylene flame, use standard tip and keep the air valve closed.

the torch by cutting off the original threads and rethreading with a ⅛″ pipe die. For burning air and acetylene, drill the tip hole out to 3/32″, and form a flared throat in the threaded end with a countersink.

Use pipe-sealing compound on all the threads when assembling the parts. Draw up the orifice tube so that the jet issues from about ¼″ back of the inner end of the tip, as shown in Fig. 1. Attach standard hose with screw clamps. Since oxygen is present, don't use any oil.

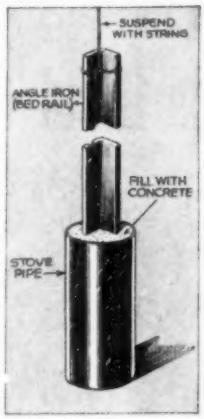
To operate the torch, crack open the acetylene valve, light, and adjust the oxygen or air valves to give a clear blue flame. If the torch fails to draw in sufficient air, as indicated by a yellow or smoky flame, the orifice may be too large, or not centered in relation to the tip opening. If necessary, solder in a new orifice strip. END

Tree Limb Makes Bird Feeder



A SIMPLE bird feeder can be made from a tree limb two or three feet long. Select a limb about 3″ in diameter. Leave a few inches of some of the branches on the limb and bore a dozen or so 1″ holes 2″ deep in the limb. Nail or tie a piece of string to the top so you can hang the feeder in a tree. Fill the holes with suet or peanut butter.—*R. M. Woodbury, Haverhill, Mass.*

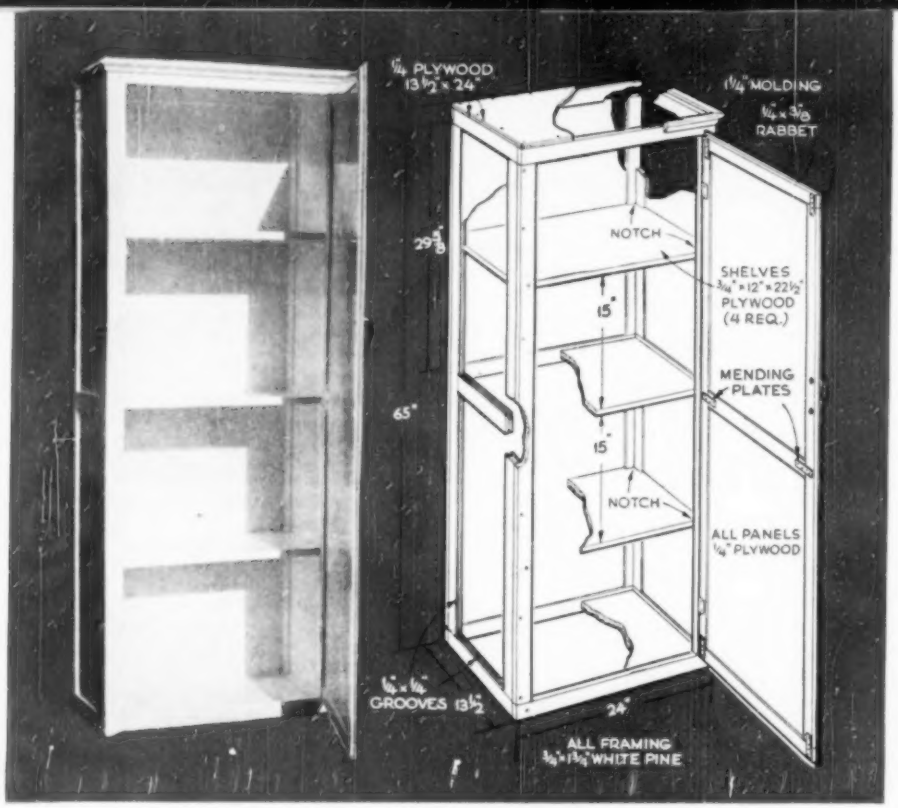
Concrete Bases for Fence Posts



STEEL fence posts often tend to work loose from the ground in wet weather. One common remedy is to dig a hole for each post and plant it in concrete. It'll save concrete, though, if you pre-cast the base in a concrete cylinder before burying it.

Obtain some short lengths of stove pipe, place each post upright inside a piece of pipe, and fill the pipe with concrete. Planted in the ordinary fashion, these heavy-base posts will stay firm even in soft ground.

If you have no stove pipe, make the base tubes from an old piece of roll roofing or linoleum. You can also use cheap angle-iron bed rail in place of regular fence posts. —*C. A. Veburg, Omaha, Nebr.*



Three-Shelf Cabinet Is Hand-Tool Job

THIS cabinet grew from a definite need. Until I built it, entirely with hand tools, we never could find enough storage space in our home for linens.

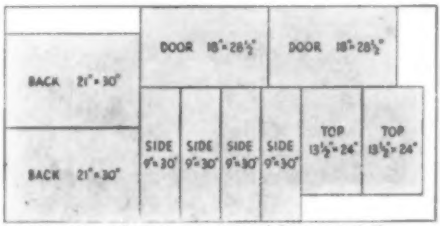
I used a rabbeting plane to cut ¼" by ¼" grooves in the framing members. If you don't have one, your lumber company will probably cut the grooves for you.

Saw up your 71' of ¾" by 1¾" pine like this: eight pieces 61½" long, two 58½", four 24", three 21", one 18", four 12", and two 9" long. These dimensions allow for ¼" tenons on both ends of all vertical members as well as the middle horizontal pieces of the frame.

Assemble the two sides and back first, fitting the ¼" plywood panels snugly into the grooves. Screw the assembled back to the sides, and then the front framing members also to the sides. Cut a ¼" rabbet ⅜" deep around the outer edges of the door to make the cabinet dustproof.

Two pieces of ¼" plywood were used for the top to make it strong enough to support any heavy object placed there.—*C. C. Hunter, Chillicothe, Ohio.*

MATERIAL	QUANTITY	APPROX. COST
¾" x 1¾" pine	71'	$5.00
¼" plywood	4' x 8' sheet	4.80
¼" plywood	2' x 4' sheet	2.88
1¼" molding	4½'	.36
Hardware		2.00
	Total	$15.04

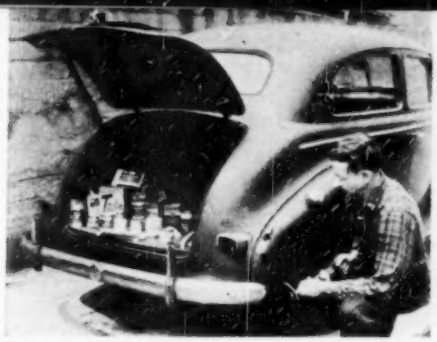


PATTERN FOR CUTTING PANELS. STOCK: ¼" PLYWOOD 4'x8'

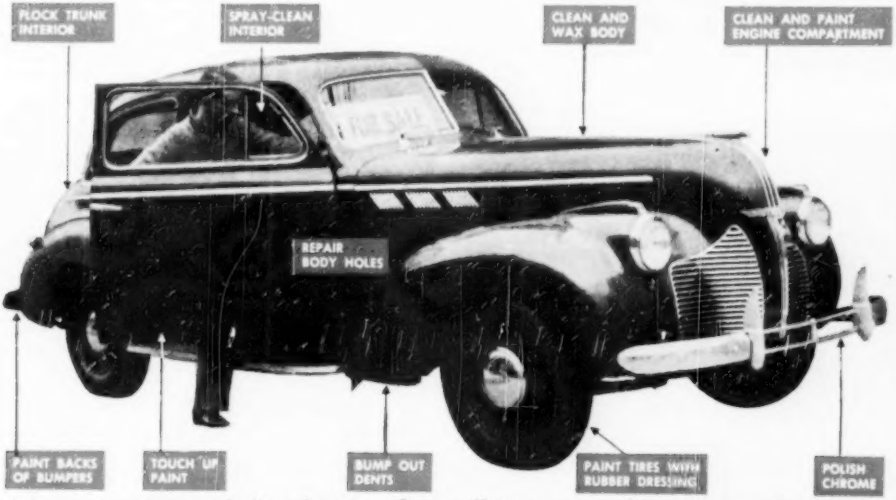
Upping Your Car's Value

By borrowing a few tricks from auto dealers, you can get a higher price when you sell or trade in the old crate.

PS PHOTOS BY W. W. MORRIS



Reconditioning materials include those above. Don't worry about fender holes like those shown here. With an inexpensive kit, you can fix them so that they will never be noticed.



A beauty treatment including the steps above will increase number of prospective buyers.

By R. P. Stevenson

THE USED car that looks good always sells best. Dealers know this by long experience, and most of them give every used car they work over a beauty treatment. You can do the same—and make a better deal.

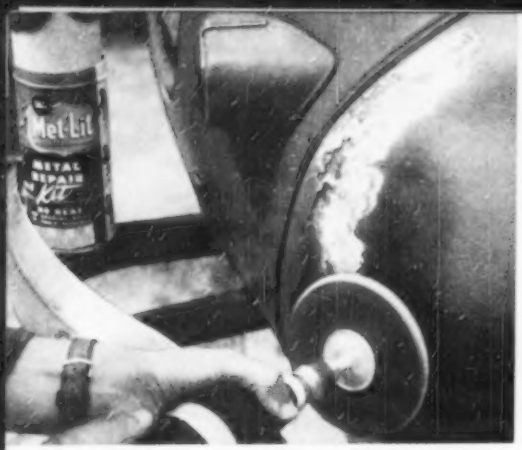
Auto manufacturers help dealers by supplying or recommending appearance-reconditioning kits. These include several materials new since the war. But most of the recommended supplies are also available to you at auto-supply stores or from the dealers themselves.

In preparing a car for sale, a dealer can often do a specific operation more inexpensively than you can and get back his investment. But you may not. Steam-cleaning the chassis and engine is a case in point. It might not pay you to have this done, even though dealers include it in the program.

There are many other jobs, however, that you can do at very little expense and effort. *These are outlined on the next four pages.* And once your car is spruced up, you may be less inclined to sell or trade it in.

One of the first jobs you can undertake is putting the body and fenders in good condition. Cold metal and plastic patches will take care of holes and small dents. The metal will fill the dents, and the patches will bridge the holes. If you want to attempt more ambitious body work, inexpensive bumping dollies from an auto-parts store will help you do the job.

To match the body paint, look on the body plate that carries the serial number. You'll usually find there a number that will enable a paint supply house to sell you the matching color.



1 Sand down to bare metal for an inch or so around rusted-out spot. You can do sanding by hand, but a power disk is quicker. Kits containing all patching materials are available.

2 Cut fabric patch to shape, dip in solvent, and apply it to the metal. The wet patch can be molded to any contour. After it's dry, featheredge the patch with fine sandpaper.

3 Apply metallic putty to patch, using putty knife or brushing it on after thinning with solvent. Sand or file the putty smooth, and it will look and last like a piece of metal.

Anybody Can Repair Rust Holes Now By Simply Applying Plastic Patches

SOON after the war someone found that a plastic-impregnated fabric was ideal for repairing rusted-out automobile bodies. Dipped into a solvent, the fabric bonded itself to the metal. A paste applied over the fabric set to metal-like hardness.

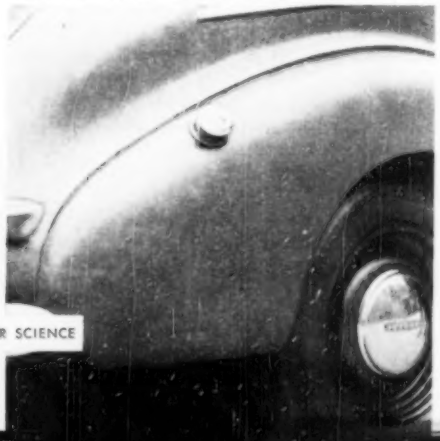
POPULAR SCIENCE announced the process in June, 1948. Since then practically all service garages have adopted plastic patching as a standard repair procedure. The patches are inexpensive and durable. Any apprentice mechanic can apply them.

To do the job yourself, you can buy a kit at an auto-supply or hardware store. The kit includes fabric, solvent, metallic putty, a small brush, and instructions.

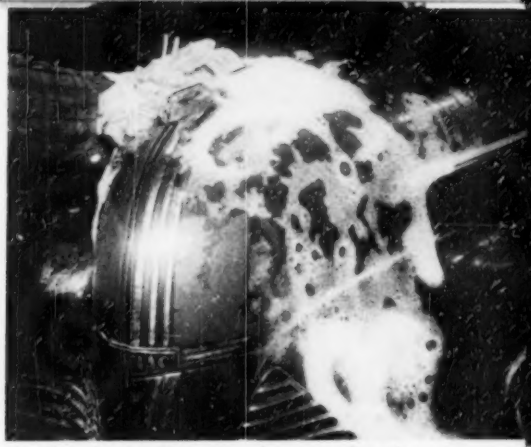
If you don't own a paint sprayer, borrow or rent one for the finishing job.

4 Spray the patch, first a base coat and then several of finish color. Rather than try to match a spot, it's best to spray entire panel. Lacquer is advisable because it dries quickly.

5 Where's the patch? When job is carefully done, you have to look closely to detect it. Garages now use the plastic-patch method for a good many of their body-repair jobs.



1 Hose car first with cold water to remove the road dust. Such dust is abrasive and would damage the finish if rubbed. Scrape and flush all dirt you can from the under parts.

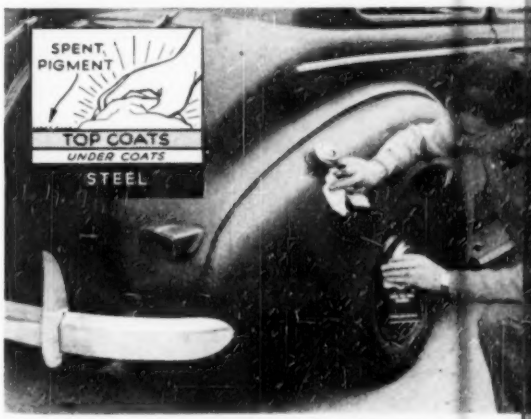


2 This looks like soap but actually it's a detergent made especially for car washing. Never use household soap. Do the washing with a clean sponge or soft cloth, rinsed often.

Knowing How to Wash Your Car Pays Off When You Sell It

WASH and polish the car after you've finished the metal repairs—and do this the right way. First, place the car in the shade and wait until the metal surfaces have cooled. Use cool or cold water, never hot. Avoid household soaps. They may leave a dull film on the highly finished surfaces. Use running water if possible.

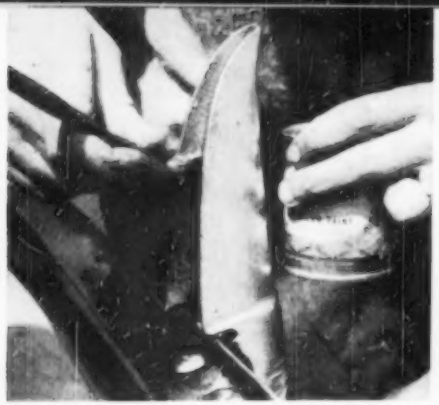
A good pre-wax cleaner will restore the original gloss to a dull finish. A polishing agent is combined with some cleaners, but the cleaning function is the most important. You can then wax the car, but you should keep in mind that some auto manufacturers discourage waxing. Their reason: abrasive cleaners may later be used to remove the wax—and cut through the finish. Consult your owner's manual on this point.



3 Use a wax cleaner next. This is the most important step in restoring the finish. As the sketch shows, this removes the thin film of oxidized paint, as well as dirt and old wax.

4 Waxing will protect the finish. Some waxes don't require power buffing. Always clean or wax a car in a shaded spot. Sun will dry the paste or liquid so fast you can't polish it.

5 Special chrome polishes are available, but you can do without them if you have rubbing compound. The Ford mechanic below uses compound—and finds it does good job.



1 **Aluminum paint** applied to the interior surfaces of bumper guards and the backs of the bumpers—if latter are badly rusted—improves the appearance. Remove rust first.

2 **Chrome can be protected** temporarily against rust by applying wax or plastic coating that comes in new spray cans. You can also use wax, light oil, clear brushing lacquer.

3 **Hub-cap dents** can be bumped out by this old trick—placing the cap in sand-filled container. It's best to use a rubber mallet, but you can get by with hammer if you're careful.

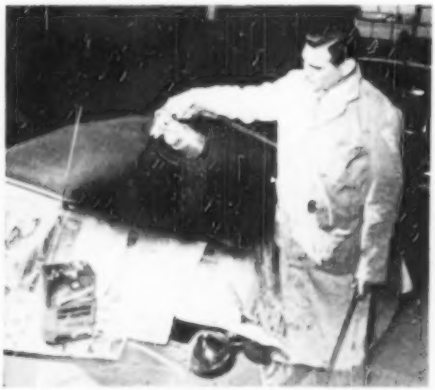
These Seem like Little Things But They Make a Car Look Better

YOU may hear a mechanic speak of "detailing" a car that's to be resold. This means giving it a final check and taking care of points that were overlooked.

Your detailing might include removing spots of tar or road oil from the finish. Gasoline, kerosene, or turpentine will usually take care of them.

Cleaning white sidewalls is another possibility. Mechanic's hand soap or any popular kitchen cleanser applied with a stiff brush and warm water will remove curb scuffs and road dirt.

If the body finish is chipped or pitted in a few places, apply matching enamel or lacquer with an artist's brush.



4 **A convertible top** can be waterproofed and made to look like new with one of several plastic coatings recently made available to dealers. Yours may be able to sell you some.

5 **Black rubber dressing** brushed on tires and running boards produces a new-rubber look. A dealer seldom neglects this, for it costs little and makes quickly noticed improvement.

1 **Commercial degreaser** is fine if you can get it. One above, part of a reconditioning kit for dealers, is brushed on and then hosed off. For use, it's diluted 8-to-1 with kerosene.

2 **But kerosene alone** will do the job. Sop it on the grease with a cloth and let it soak awhile. Then mop up the grime with succession of cloths, or scrape and wire-brush it off.

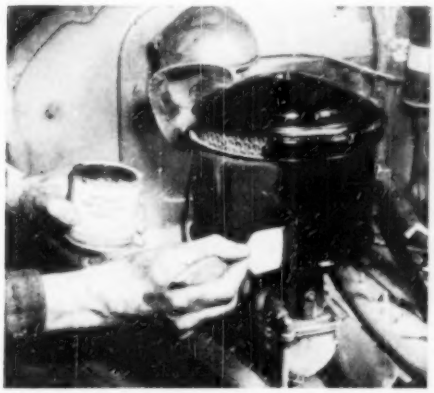
Everyone Looks under the Hood —So Clean and Paint the Engine

A CLEAN engine always impresses a buyer, for it suggests good mechanical condition. An hour's work with a dollar's worth of materials will make yours glisten.

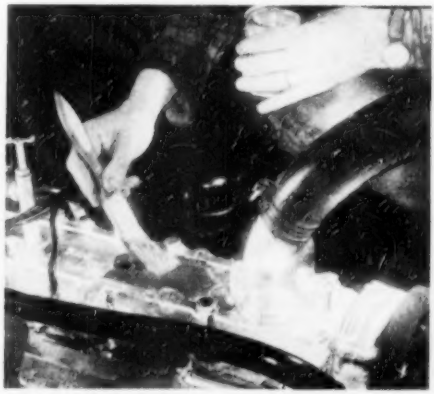
Removing the grease and grime may be a tedious job, but the results are almost always worth the effort. If you have trouble locating a degreaser, the one pictured in the photo above is sold to garages under the trade name of Whiz Ho-Zof.

Next month, read how to renovate the interior of your car with a spray gun. A plastic spray now reaching the market will make the door panels and headlining look new—even if they are now faded and dirty.

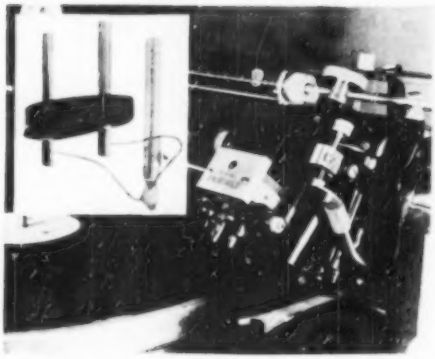
3 **Touch up radiator hose,** heater hose, and battery cables with rubber dressing after cleaning with a cloth. A small can is all you need for this, the tires, and running boards.



4 **Brush black enamel** on air cleaner, starter, generator, battery case, horns, fan blades, radiator top tank, and similar black accessories. Compartment panels can also be painted.

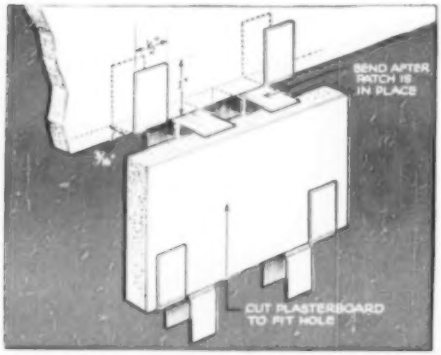


5 **Apply engine gray** or aluminum paint to head and block. Use only a paint that's made for the purpose. When job is done, let the paint dry overnight before running engine.



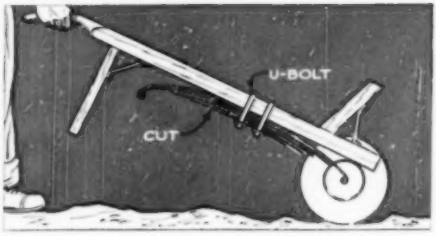
Heated Stylus Cuts Noise

MUCH of the noise on a phonograph record is believed to be scratched in at the time the original recording is made. A recording technique recently developed by Fairchild Recording Equipment Corporation, Whitestone, N. Y., employs an electrically heated stylus to reduce noise in the original cutting. A heated needle may be compared to a warm butter knife. It softens the lacquer and thus makes the groove smoother. The smoother groove is said to keep noise about 70 decibels below the signal level; for ordinary disk cutters the difference is only about 50 db.



Clip Holds Plasterboard Patch

A SMALL hole in plasterboard wall can be patched with a scrap of plasterboard and clips cut from tin-can metal. Snip the metal as shown and bend three of the four legs around a plasterboard form. After the patch is in place in the squared hole, bend down the fourth leg of each clip. Finish smooth with patching plaster.—*John A. Vincenti, Kennett Square, Pa.*



Barrow Uses Old Auto Springs

IF YOU'RE building or repairing a wheelbarrow to be used on rough ground, don't overlook the use of old auto springs as wheel mounts. They absorb some of the shock that would otherwise be transmitted to your arms. Two, three, or more spring leaves can be clamped to the barrow frame with U bolts. A long bolt or a threaded rod through the shackle holes carries the wheel. —*Marion L. Rhodes, Knightstown, Ind.*

Screwdriver Made from Key

THIS key-chain screwdriver is as handy to carry as it is to use. You can make one from a discarded steel key simply by sawing off the end and filing or grinding the shank. If you want to make the bit more durable you can case-harden it, but for light use this isn't necessary.—*W. H. McClay, Pasadena, Calif.*

Fast Way to Make Storm Sash

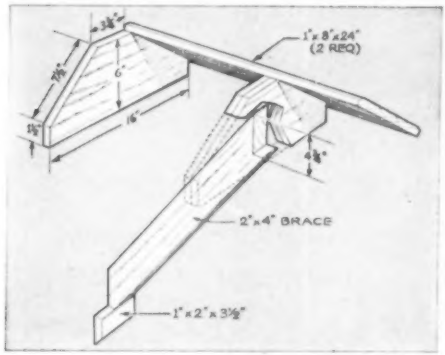
PUTTYING is unnecessary if you make storm sash like this. Miter the corner joints and groove the inner edges on a circular saw to accept the glass. Assemble three sides, slide the glass in place, and add the fourth side. The window won't need putty if you paint the wood before assembly and let some of the paint run down into the groove.—*Walter E. Burton, Akron, Ohio.*

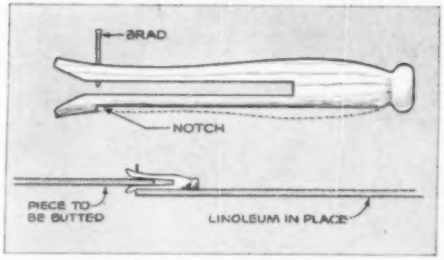
Why Rats Thrive in Winter

MANY farmers wonder why their wintertime rat-poisoning campaigns show such poor results. One reason is that most poisoned baits freeze hard in cold weather so the rats can gnaw off only enough to make them sick—and wise. To make winter baits more effective, mix in mineral oil and some fat or suet. They'll keep the mixture soft enough to permit rats to chew off a lethal dose.—*John Krill, North Lima, Ohio.*

Support Holds Saddle on Wall

THE wooden horse shown above keeps saddles in shape and out of the dirt. It takes up very little space and has no legs to get in the way. The sketch below shows you how to assemble one like it. Take care, however, not to leave any projecting nails or screws that might scratch the leather or lining. Also bevel or round off the edges.—*David F. Costello, Ft. Collins, Colo.*





Pin Helps You Lay Linoleum

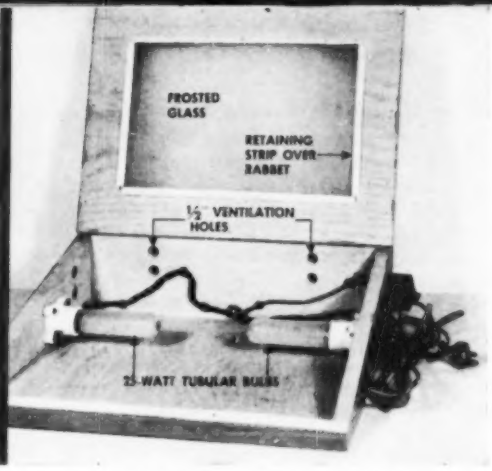
A SCRIBING tool made from an ordinary clothespin will help produce a professional job when you must butt a piece of linoleum against another already in place.

Cut a notch or shoulder and face off one prong of the pin as indicated by the dotted line in the sketch above. Drive a sharp brad through the other prong directly opposite.

Cut the new piece of linoleum a little oversize. Then when you slide the shouldered prong along the edge of the piece already on the floor, the brad will scribe a straight cutting line on the second piece.—*Alfred K. Purnhagen, Freeport, N. Y.*

This Anvil Is Easy to Move

HEAVY anvils are often tough to move, but Clarence McCutcheon, of Hamilton, Mo., can get his around the farm shop without much trouble. He welded an angle-iron box on top of an old tractor differential housing and set the anvil in the box. The anvil can be lifted out or tipped and rolled with the base.—*L. Houck, Jefferson City, Mo.*



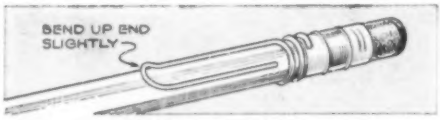
Tracing Will Amuse the Kids

Now that it's time for your youngsters to begin moving indoors to play, a tracing bench will help keep them busy.

Knock the box together from any wood that's available. A base 14" by 20" and a rear height of about 6" are good dimensions. Cut out the top rectangle slightly smaller than your sheet of ground glass, and cut a rabbet for the glass. Bore ventilating holes and screw the top in place. Connect up two tubular lamps or 15-watt fluorescents.—*John P. Arnold, Doylestown, Pa.*

Screw Eyes Support Shelves

A COUPLE of large screw eyes at each end afford a neat and easy way of supporting a shelf. In this photo, the shelf is raised to show the screw eyes. —*J. A. Richards, Saco, Maine.*



Pencil Clip from Paper Clip

A PAPER clip can be easily bent to serve as a pencil clip. Straighten out one end and wrap it around the pencil as shown.—*W. K. Lowry, Toronto.*

WATER PAINTS

Type of Paint	Where Used	Kinds of Surfaces	Preparation of Surfaces
Calcimine, whitewash, other glue-bound water paints	Walls and ceilings of living rooms, dining rooms, bedrooms, halls, basements	Use only on surfaces not subject to dampness. Plaster, wall board, wall paper, primed wood, old painted surfaces	(a) Remove old calcimime. (b) Ordinarily no primer is necessary. (c) Surface should be clean and dry. (d) Plaster of uneven porosity requires oil- or water-type priming coat
Casein and casein-soybean paints	As above	Where normal conditions prevail, but where maximum washability is not expected	As above
Resin paints, interior type	As above	Surfaces subject to moisture or that must be washed frequently.	As above
Resin paints, exterior type	Exterior walls	Where surfaces are subjected to dampness, rain or snow. Brick, stone, concrete, concrete block, asbestos shingles, and old painted surfaces	See that surface is clean and free of dust
Cement powder paints	Interior or exterior walls	As above	Surface should be damp during application

Note: All types of paint are reduced with water according to the manufacturer's directions. They are applied with a brush, but may be sprayed if suitable equipment is available.

FOR YOUR POPULAR SCIENCE INFORMATION FILE

Two-Story House Better for Dog

HERE'S a two-level shelter that will keep your dog warm in the winter, cool in the summer, and dry when it rains.

The upper story has no openings above the floor level. In cold weather, when your pet sleeps in that room, the heat generated by his body will keep him comfortable since there are no above-floor openings to let the warmth escape.

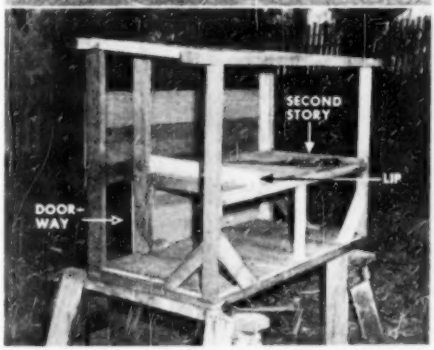
In the summer, the lower level will be cooler because it's separated from the roof by the second story.

The construction is simple. Butt joints were used throughout. The framework is two-by-threes with braces at three of the lower corners.

The size of the kennel, of course, will depend on the size of your dog. Here's a simple rule to determine the size: build the house large enough so the dog can stand up, in his upstairs room, without touching the walls or roof.

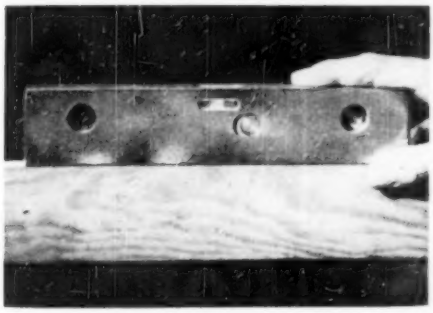
These tips will help you:

- Provide a removable roof or large door for cleaning.
- Fit the boards tightly to minimize cracks that will allow wind and rain to enter. Better still, before nailing up the siding, apply a layer of building paper.
- Put on a good roof of tar paper or shingles.
- Install a lip on the floor at the entrance of second story. This will keep your pet's bedding from dropping to the lower level. Cedar shavings make good bedding. Fleas don't like cedar.
- Use brick or stone supports, and set the house dead level and firm. You wouldn't want to live in a tipsy house, either.
- Clean out the house three or four times a year and wet down all inside surfaces with DDT.—*Erik Miller, Burbank, Calif.*



Neat appearance of finished kennel is shown in upper photo while lower picture shows simple construction of double-deck doghouse.

Level Lights Up for Working in Dark Places



PUSH the sliding switch on the front of this level and a one-cell flashlight bulb inside the case lights up all three level bubbles. The tool shows horizontal, vertical, and 45° angles. It's priced at about $5 by the International Manufacturing Co., of Littleton, Colo., and is especially handy when you're working in a poorly lighted spot. Although the level uses only one penlight cell, there is room inside the aluminum case for a spare cell. New bulbs and batteries are easily installed by removing two screws that hold the back of the case in place.

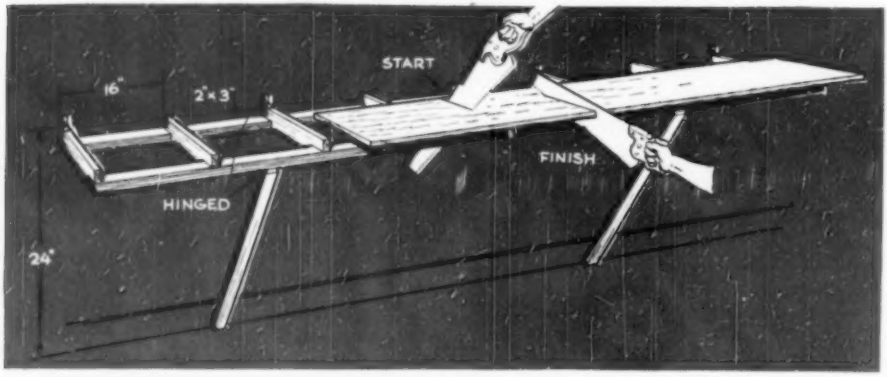
How a Small Shop Can Handle Big Work

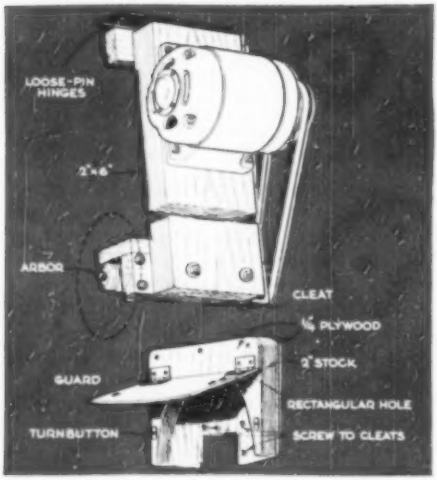
By Edwin M. Love

Here are some neat dodges to help lick the handicap of crowded working space.

NEAR-TOP bugbear of the home craftsman is the problem of managing large work in his small shop. The long board that must be cut into usable lengths teeters precariously on his circular saw; the far end of a door stile he is boring for dowels wavers on the drill press; the table-top edge, neatly molded at the start, is disastrously gouged as the projecting end overbalances. Then there is the awkward business of jointing long stock or of gluing up such sizable projects as a bench top.

Wall rack and swing saw crosscut awkwardly long planks.





RESTING a long board on horses and cutting it with a handsaw the usual way isn't consistent with the goal of mechanizing your shop wherever possible. If the handsaw must be used, it's better to build an open shelf framework (above) attached rigidly or hinged to a wall to support the lumber.

Use 2" by 3" lumber, assembling the frame by notching the cleats over the rails and placing them opposite the wall studs. Two or three legs hinged beneath the front edge and swung against the baseboard will support the shelf rigidly.

Boards resting on this shelf can be crosscut into shorter lengths at any point. A full stroke of the saw may not be possible, but the work can be drawn forward at the start of the cut and pushed back to complete it. By lowering the handle of the saw at the end of the cut, the front rail of the shelf is

cleared and the near edge of the board is kept from splintering. There's no overbalancing of the rear edge as the saw comes through.

A swing saw used with such a wall shelf will cut boards in a jiffy. The handy arrangement at the bottom of the facing page will enable you to swing a fast-cutting crosscut blade through the board as it lies on the shelf.

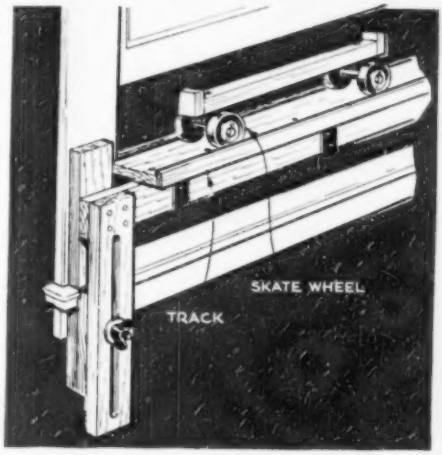
True up a well-seasoned 2" by 6" plank of convenient length, bolt a ball-bearing saw arbor to a cleat at the lower end, and hinge the plank to the joists overhead or to a stout shelf. The position of the motor is governed by the belt. A long belt will place it near the upper pivot, where its weight will have little influence on the handling of the saw, but a long belt will tend to whip.

The weight of a motor placed lower can be offset by attaching a coiled spring to the front of the plank and connecting it with the ceiling or an extension of the shelf to which the plank is hinged.

Hang the machine at such a height that the blade will cut through a wide 2" plank. A guard like the one shown, built of ¾" plywood sides and a spacer arch of 2" stock, is screwed solidly to the ends of the cleats. Hinging the outer end gives clearance for blade-changing.

Be careful to align the pulleys and especially to keep the blade in the plane of the swing. This may require a little shimming of one end or the other of the arbor to compensate for twisting of the plank if it warps after it has been in use for a few months.

With this rolling carriage you can let long lumber stick out the window.

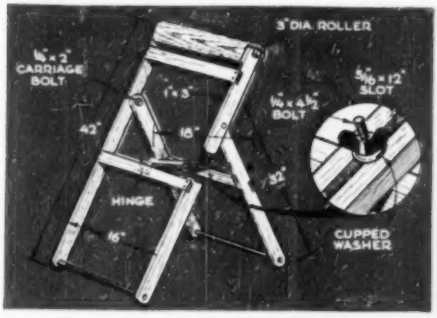


If a window is handy where the end of a board can be passed through it, a table saw will do nicely in crosscutting long stock when a simple accessory is provided. With the end supported at the right height, the only problem in cutting a board is to advance it evenly across the table; and this is accomplished if the outboard end is carried by a roller carriage. Just take the rollers off an old skate and mount them on a board, and make a shelf-like track for this carriage that can be bolted across the window and adjusted for height. When adjusting for height, keep the track level. If there's no window handy, you might use a door.

Roller stand beyond saw or jointer helps you work king-size stock.

Machine-ripping long boards is easy if the projecting end of the work is carried by a roller stand. In building such a stand, it's smart to provide enough vertical adjustment for use with both saw and jointer. The roller can be 2" or 3" in diameter. To adjust for height, place the stand near the machine and align the top of the roller with the table, either by sighting or with a straightedge.

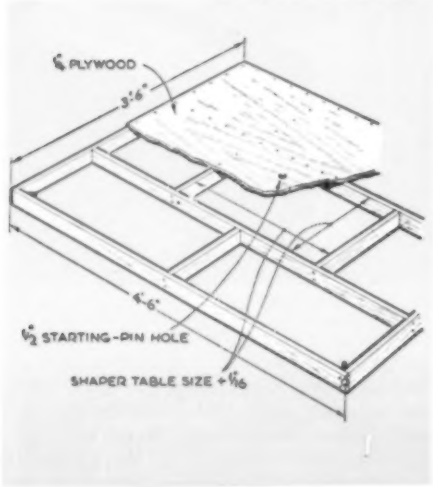
Two types of roller supports for ripping



and jointing long boards are shown on the previous page. The upright stand is quickly readied and occupies little floor space in use, but the folding version can be hung on the well out of the way. The cross-rails and rungs—glued and nailed—give rigidity.

Note that the back legs are pivoted near the back edge of the other legs, allowing for the inset of the rails when the stand is folded. The adjusting arm is slotted as needed to allow the clamp bolt to slide as the height is adjusted.

Oversize shaper table lets you handle big pieces.



LARGE work, especially big open frames, cannot be molded on a small shaper. The solution is to build a light framework at least 3′ by 4′ in size to rest on the shaper table, facing it with ¼″ plywood. If the weight of the work demands it, attach legs to the corners of the wooden table.

Bolting on a big auxiliary fence takes the tilt and rock out of edge work.

EDGE-GROOVING, jointing, or shaping wide boards on the jointer is easier if a wide auxiliary plywood fence is screwed to the regular fixture. If it springs from pressure of the work against it, brace it with a strip of wood tacked near the upper edge, with the other end clamped to the edge of the adjoining saw table or other support.

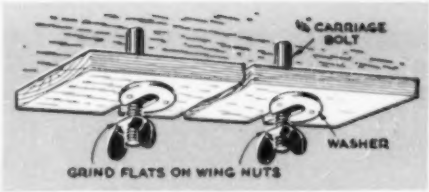
A similar setup with a circular saw helps in jointing, shaping, and grooving operations on wide stock.

Plank on a drill-press table licks the problem of overhang and teeter.

LONG work to be bored or mortised can be handled better if a 2″ by 6″ plank is bolted to the drill-press table to carry the piece. Use wing nuts to tighten the bolts. Attach fences to this auxiliary table as needed.

A stiff piece of fir about 8′ long will handle almost any job likely to be encountered. Place it with the hollow face up, if it is warped. Bore it to take two carriage bolts, counterboring to sink the heads flush, and

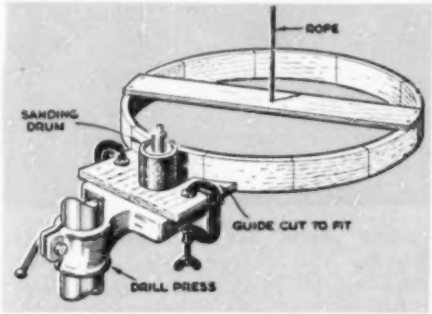
grind flats on the side of wing nuts so that they can be passed through the table slots without being screwed off the bolts. The slotted hardwood piece (right), with the open washers nailed to it, is slipped between the underside of the table and the wing nuts to take the pressure. Screw fences to the plank, as needed.



Rope from joists supports round jobs for sanding on a shaper.

LARGE, circular construction, such as the apron for a round table, can be handled in sanding operations on drill press or shaper by bridging the diameter with a slat and hanging the assembly by a rope. Rest the edge of the ring on the machine table and use any convenient guiding device to locate it against the sanding drum. If the rope is tied to a swivel or passed through a ball bearing, it won't twist and lift or lower the work.

Here a guide, cut to the profile of the finished curve, regulates the depth of cut.



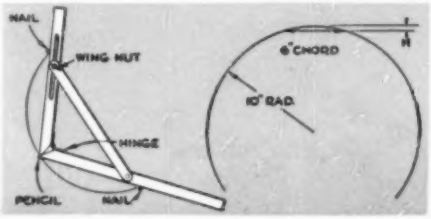
Drawing long arcs with a triangular scriber.

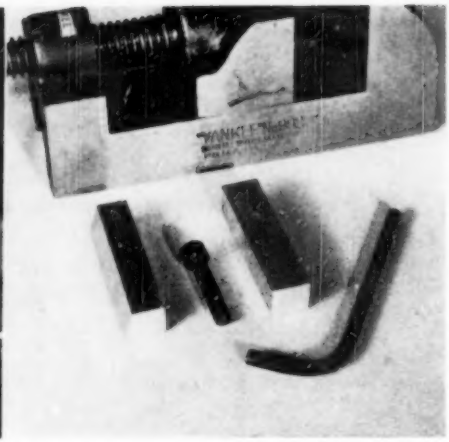
SCRIBING an arc of long radius is always a problem if a stick or cord is used for a compass. Much simpler is the triangular-scriber method. At the ends of the arc chord, drive small nails into the board to be cut. Locate the height of the curve at the center. Hinge together two long straight strips. A crosspiece and thumb nut and bolt will hold the hinged pieces at a set angle. Cut a notch, as shown in the photo, to hold the point of a pencil at the apex.

By sliding this adjustable, gable-shaped device endwise—keeping the legs always in contact with the nails—a pencil in the notch will draw a true arc.

If you don't know the height of the arc at the center, but do know the radius, make a drawing to scale and measure the height.

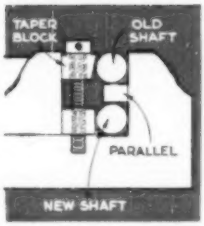
For instance, if the radius is 100″ and the chord is 60″, draw an arc with a 10″ radius and a 6″ chord. Find the center of the chord and measure to the circumference of the circle and you've got the proportionate height of the required arc. END



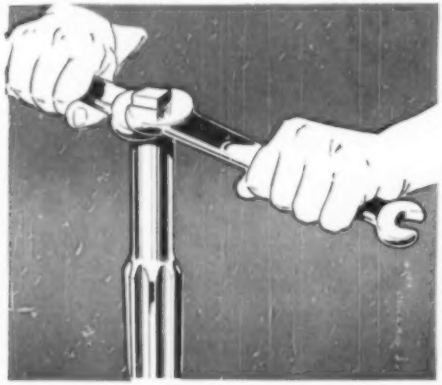


Extra Jaw Grips Duplicate Work. This device holds two similar pieces in a drill-press vise in alignment but permits you to remove the upper one at will. With shafts having taper-pin holes, for example, it will help you to duplicate the original holes in new shafts even if the holes are not on center, and the original collars or other parts will still fit the new shaft.

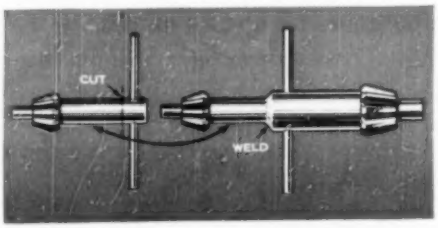
The fitting consists of a rectangular block threaded for a tightening screw that passes through a clearance hole in a tapered upper block. For larger drill-press vises, make the bars 1" wider than the jaws and use two clamp screws, straddling the jaws.



Clamp the new work in the vise with the lower block. Put the old piece above it, with a parallel between, and tighten the tapered block to wedge it tight. With the drill or reamer in the old hole, clamp the vise on the drill-press table. Then loosen the tapered block to remove the old piece. *—Harry Moore, Hamilton, Ont.*

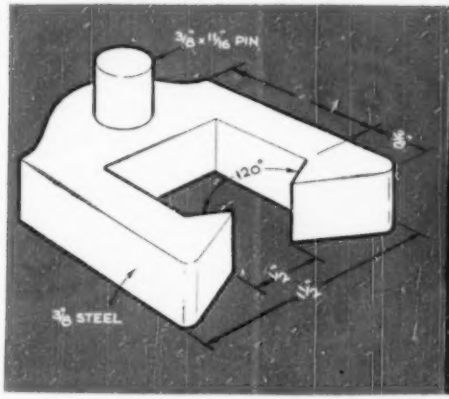


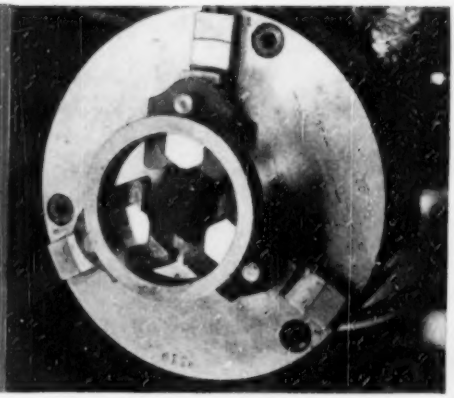
Tapping Blind Holes. A good dodge to facilitate this job is to pack the blind hole with heavy grease first. Then, as the tap enters, chips are forced out with the grease.*—Warren Norcross, Phila.*



Improvised Tap Wrench. If you haven't a tap wrench big enough to fit a large tap or reamer, try using two open-end wrenches as shown above. Placed opposite each other, they give the balanced pull needed to hold the tool true, and ample leverage for turning it.

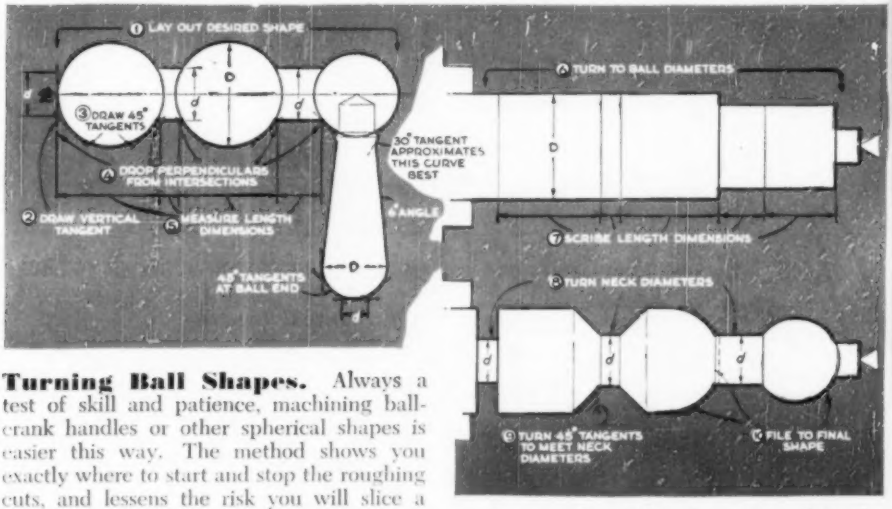
Siamese Chuck Keys. Where two sizes of drill chucks are used interchangeably on a drill press, it's always a problem to keep the right key handy. You will, if you cut one of the keys just below the crosspin as shown, and weld or braze it to the other. *—John A. Blaker, Auburn, Mass.*





Jaw Holders Help True Chuck. To true up a universal chuck by grinding the jaws, you should do it while the jaws are exerting holding pressure just as they will in use. These shopmade fittings do just that. Cut from flat ⅜" stock, they are sized to fit a 6" chuck.

The fittings slip over the ends of the jaws, and must clear the holding surfaces to be ground. Make certain that the steel pins are identically located on the fittings. Any size of ring can be used as long as it leaves the jaws open.—*M/Sgt. James R. Wood, 3rd Air Vehicle Repair Squadron, U. S.* ***Air Force.***

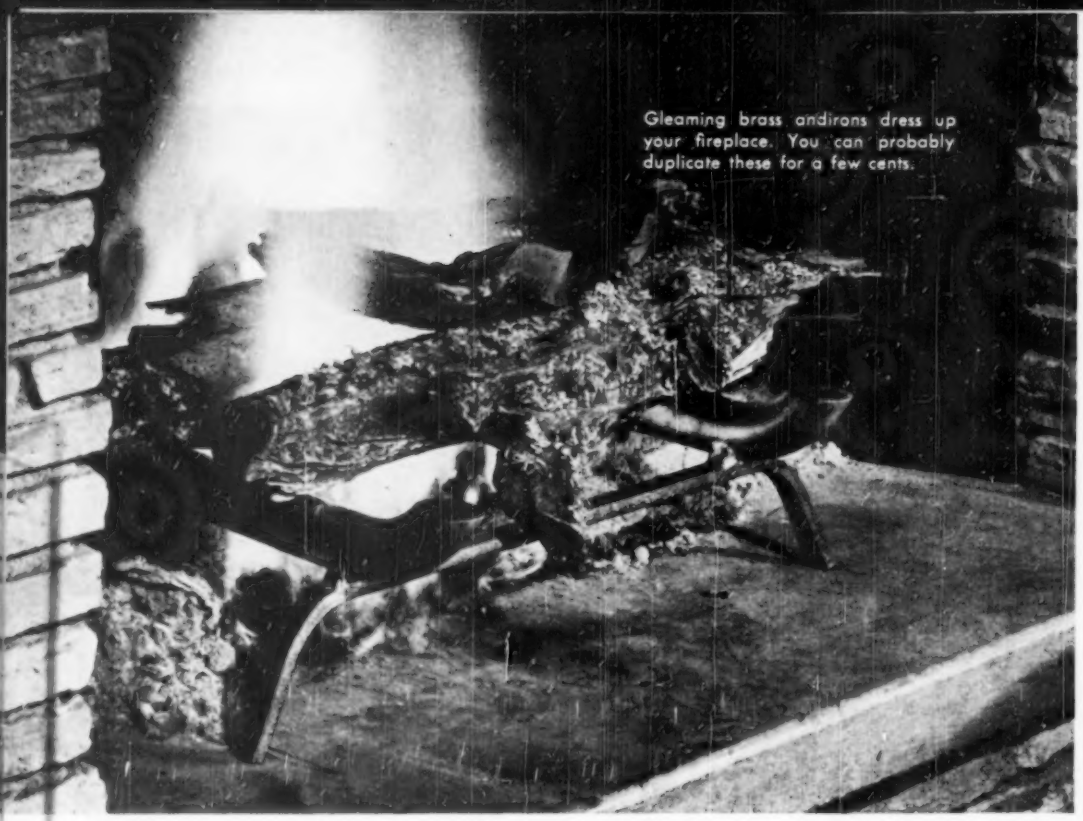


Turning Ball Shapes. Always a test of skill and patience, machining ball-crank handles or other spherical shapes is easier this way. The method shows you exactly where to start and stop the roughing cuts, and lessens the risk you will slice a flat off the ball or leave too much stock.

First draw along a centerline a layout of the piece desired, making it at least four times actual size to minimize drafting errors. Draw tangents to the ball shapes that are 45° to the center line. From the intersection of the tangents and the necks joining the balls, drop perpendiculars and measure the longitudinal distance between them.

These dimensions, reduced to actual size, should then be scribed on the chucked workpiece after it has been turned to the larger diameters, *D*. Locate and turn neck diameters *d*, with a cutoff tool if necessary.

Now set the compound at 45° and turn from the large diameters to the neck diameters. Use only the compound feed and stop cutting just as the neck shoulder disappears. This leaves a little stock at the outer and inner corners to be filed off. For best results, use a template to guide the finish filing.—*C. W. Battels, Akron.*



Gleaming brass andirons dress up your fireplace. You can probably duplicate these for a few cents.

How to Make Low-Cost Andirons

Part of an old brass bed and two pieces of strap iron are all you need.

Basic materials (left) were part of brass bed and strap iron. If very large logs are to be supported, legs must be at least ¾" thick. Curved ends of tubing (below) should be cut parallel to straight portion.

By Bob Gilmore

I HAVE a neighbor who would be an asset to any community—he's a high-class scrounger. If he goes for a walk, he always comes back with some kind of junk.

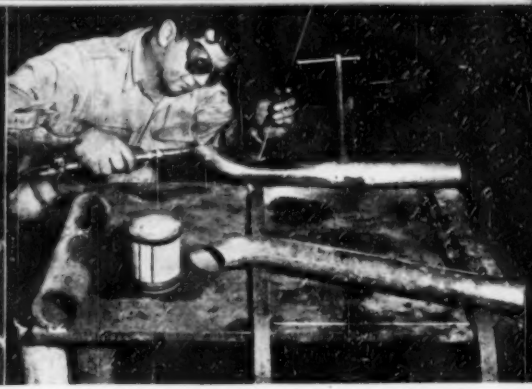
He poked around in a trash pile in a gully the other day and came home carrying an old bed frame. He dropped the foot section in my driveway, and said:

"Present for you. Brass tubing. You should be able to find some use for it."

After studying the tubing awhile, I decided Old Scrounger was right. It would make a set of andirons for our fireplace—saving us the money we'd intended to spend on a store-bought fire basket.

Some ½" by 1" strap iron from my scrap basket, the brass tubing and two hours' work turned out the andirons pictured here.

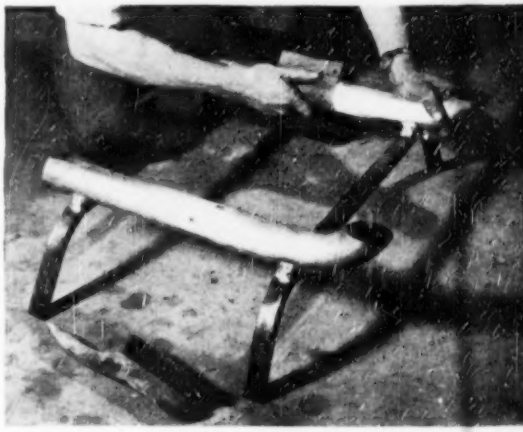
Strap-iron legs were clamped in vise and bent cold, using piece of steel pipe as lever. Determine length that best fits fireplace, add 5" at each end and bend at those points.



Align leg pieces parallel and square up tubing with them. Clamp rigidly for brazing. Flow the metal under curves of tubing and build up substantial shoulder on each side of tubing.

Fill brass tubes with wet 50-50 cement-sand mixture. This strengthens them, helps prevent heat damage. Before pouring, tape any bolt holes, close ends with taped-on wood blocks. Leave blocks on for a day, and let andirons cure for four more days.

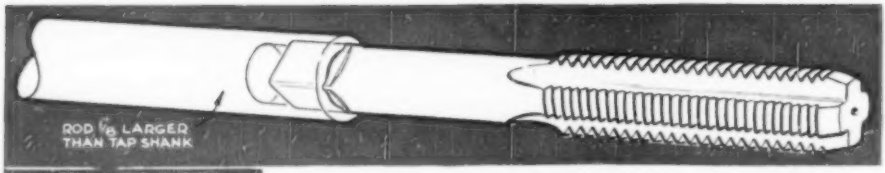
For the final cleaning operation (right), use wire brush to remove scale and any traces of old paint or lacquer. Shine up the brass with brass polish or with emery cloth. For a rich contrast, paint legs with black stove polish.

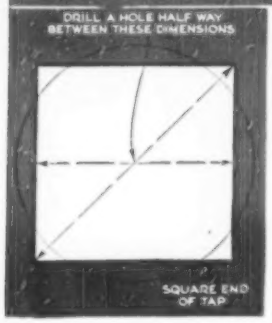


RUST PREVENTIVE

HEAT one part ordinary rosin and six parts lard slowly until the rosin is completely melted. Thin this to a flowing consistency with benzine. If ½ lb. lard was used, for example, add about 1 pt. benzine. Apply sparingly to the steel, but first be sure the metal is clean and all rust spots have been removed with emery cloth or fine sandpaper. One of the leading manufacturers of chisels has found that tools rubbed lightly with this mixture will resist rust even when immersed in salt water and left for some time.

FOR YOUR POPULAR SCIENCE INFORMATION FILE





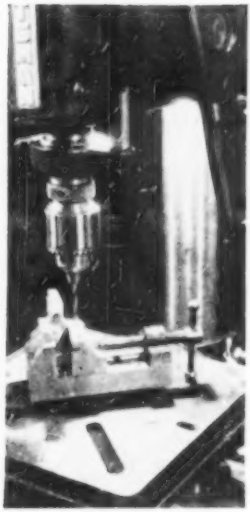
Extended Shank Gives Taps a Long Reach

When you have to tap or ream a hole that's out of reach, a tool extension can be made from cold-rolled rod. In one end of a suitable length of rod, drill a hole of a size just between the diagonal and across-flats dimensions of the square on the shank. Heat the drilled end red hot and force the shank in. The corners will shape recesses for themselves.

If possible, chuck the socket in a lathe and hold the tool in the tailstock, forcing it in with the handwheel. This will insure alignment of tool and extension. Put a pin in the other end of the extension, or file it square to fit a tap wrench.—*Geo. Petersen, Whitinsville, Mass.*

Screw Becomes Socket Wrench

Hollow-head cap screws are easily converted into handy midget socket wrenches that can be mounted in optical or jeweler's screwdrivers as shown, or fitted with individual handles. With the hex socket running on the tailstock center (preferably a ball-bearing one) turn the shank to fit. Rechuck and face the socket, leaving it a bit deeper than the nuts it will fit. Drill a hole up into the socket to clear screw shanks as the nuts are run down.—*Floyd McGuckin, Ridgewood, N.J.*

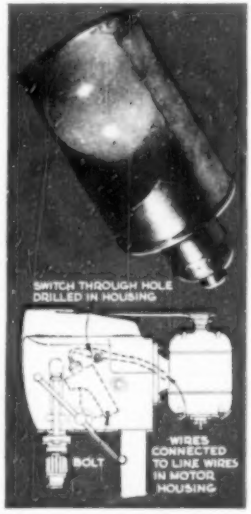


Hidden Light for Drilling

If your drill press has a hollow housing like mine, you can install a lamp that's never in the way, lights the work well, and won't get broken. How? By putting it in the housing.

Try various bulbs for fit (mine is a 75-watt) and get a tin can to fit the bulb closely. Cut a side of the can as shown and a hole in the top for the socket. Solder the socket in to bring the bulb almost to the bottom of the can.

Punch two holes in the cut corners of the can and drill the housing for the mounting bolts. Connect the lamp wires to the line, but on the live side of the power switch, as light is often wanted with the motor off. An extra switch can be mounted on the housing as shown.—*Will Thomas, Buffalo, N.Y.*



Dual Blower Whisks Cooking Odors Outside

PROVING two blowers are better than one, the kitchen exhaust unit shown here gets rid of cooking odors fast and keeps grease-laden fumes off the walls. One side of a dual blower (bought at a war-surplus shop) is connected by a flexible pipe to a hood over the gas range. Most of the heat and cooking odors pass through this. Any that escape are caught by the second blower, which sucks air from near the kitchen ceiling.

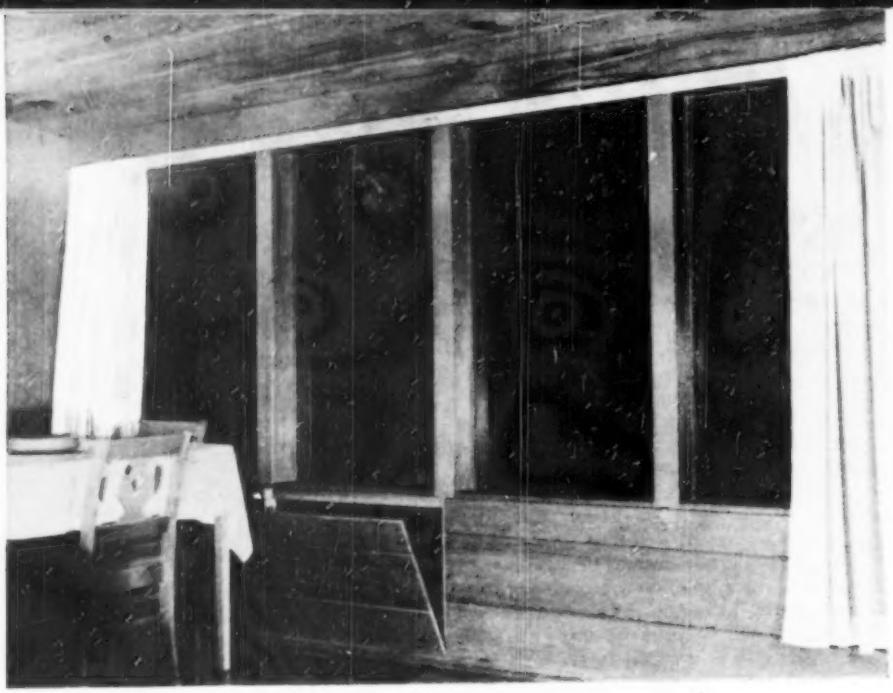
The little blower draws 62 watts. It's mounted, over a hole, on a piece of ¾" plywood painted to match the woodwork and held in the window frame by small brackets. The upper sash is lowered to accommodate this panel.

A stove hood can be made to order by any sheet-metal shop. All joints should be crimped together, not soldered. The hood can be held on wall brackets on the stove itself, or from a kitchen cabinet. Auto-supply shops stock flexible exhaust pipe in several sizes. It can be painted like the walls to be less conspicuous.

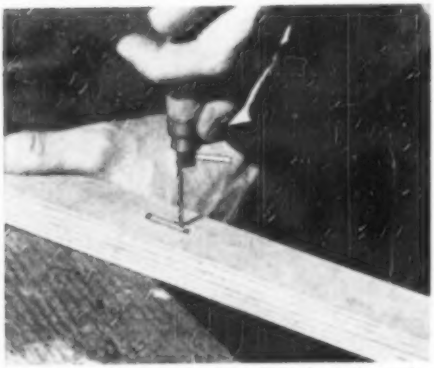
Be sure to wash grease-catching surfaces with a detergent regularly so they won't be a fire hazard.—*William Maron, Elizabeth, N. J.*

Tractor-Mounted Saw Rig Swings Down for Use

NEEDING a power saw for sharpening fence posts in the field, August Hirschvogel, of Jefferson City, Mo., put one right on his tractor. Hinged to the front end of the frame, the rig is held up when the tractor is under way, as shown above. Loosening wing nuts lets it drop to the ground, ready for use. A flat belt drives it from the power take-off.



King-Size Curtain Pole for Two Bits



Cut slots in center and each end of the pole. Simplest way is to drill holes at the ends of slots, then cut between them. Smooth wood, sandpaper edges and corners, and wax it.

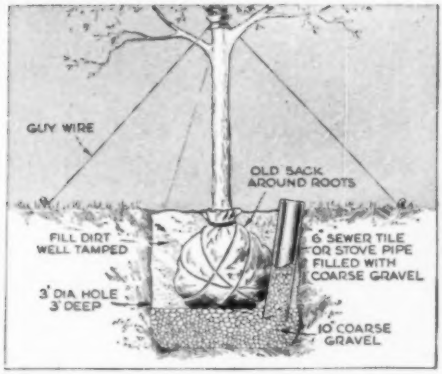
I HAD curtained dozens of windows before I hit upon a really simple system. Instead of buying a special pole and mounting brackets, I hung the curtain for this 8-ft. picture window on a length of 1" by 1½" lumber. This blends in nicely with the walls, requiring no cornice. The curtain can be taken down without dropping the rod, and the total cost was only about 25 cents.

The 1" stock I used is actually ¾" thick; you could get by with a thinner piece for small windows. The 1½" width seems about right for lengths up to 8', but I'd use stock 2" wide for longer windows. You can hem the curtain and slide it on, or use rings.

Making the pole overlap each side of the window a bit will make the window look bigger.—*Darrell Huff, Sonoma, Calif.*

Mounting blocks are cut from the same lumber. Drill a screw hole in the center of each block, and assemble the pole by attaching a block to each slot with a washer under the wood screw.

Then put up the rod. Tighten center screw, but leave end ones loose, to serve merely as supports. On masonry walls, you can use anchors or put in toggle bolts. This curtain was hemmed to slide on the sanded and waxed pole.



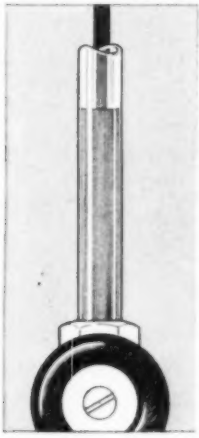
Trees Transplanted Easily

HERE's a good method of transplanting trees this fall—especially in locations where it is inconvenient to water them often.

Dig a hole about 3' deep and 3' in diameter. Cover the bottom with about 10" of coarse gravel. Place a sewer tile or stovepipe at one side of the hole and fill it with coarse gravel. Now you're ready to put the tree in the hole. Don't bother to remove the sack around the roots; it'll soon rot away. Tamp the soil down well around the tree and guy it to keep the wind from blowing it over.

Watering is done through the tile or stovepipe. This creates a reservoir of water at the bottom, causing the roots to grow down. Roots tend to grow shallow if the tree is watered only from the surface. You can also add plant food to the water.—*Wilber H. Fulker, Monument, Colo.*

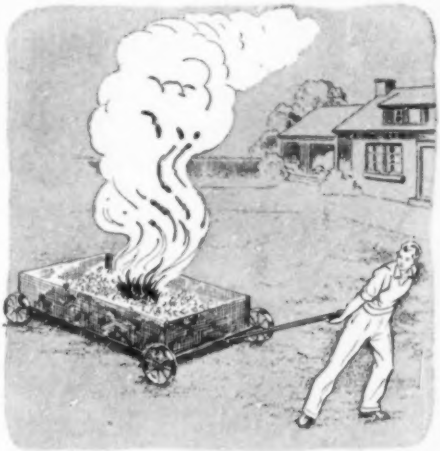
Tape Helps Check Gauge Level



EVEN under well-lighted conditions, it's sometimes difficult to see the correct water level in a boiler gauge. I've found that a ¼"-wide strip of red cellulose tape stuck to the back of the glass tube is a help. Above the water level, the tape appears narrower than it actually is. Below the water level, it is magnified, so the tube seems filled with red liquid.—*R. McClung, Hitchins, Ky.*

Work Cart Powered By Hand

MOTIVE power for this cart—built by the Mov-n-Bench Manufacturing Co., Kenmore, Wash.—is supplied by a hand lever and ratchet driving a rear wheel. The cart enables a worker to sit comfortably while doing such jobs as planting or weeding.



Ash Cart Fertilizes Lawn

LOTS of good plant food is wasted every fall if you rake leaves off the lawn and haul them away. Much of this can be saved by using a burning wagon made of metal. The bottom is an old bedspring covered with metal lath. Woven wire 18" wide forms the sides. Any old iron wheels will do—old cultivator wheels are ideal. In use, the wagon is pulled over the lawn as the leaves are raked up and burned in it. Moving the wagon scatters the ashes over the lawn.—*Hallie H. Holt, Springfield, Ill.*

These Are Photos I'll Always Remember

By Joseph Costa,

Chief Photographer, N.Y. Sunday Mirror Magazine, *and Chairman of the Board, National Press Photographers Association.*

A veteran cameraman tells how he takes pictures that spice the headlines.

YOU may recall that sensational case in Ohio in the late Twenties—the trial of Professor James Snook for the love-affair murder of Theora Hix, one of his students. I'll never forget it, for I learned then that a photograph can sometimes perform a public service.

The trial got off to a slow start. It was a week before the first juror, a woman, finally was seated.

Next day, during the noon recess, the newspaper reporter I was working with called me aside. The woman juror, the reporter said, was lunching at the counter in the courthouse basement—and chatting with one of the defense attorneys!

A good picture—one that any cameraman would give his shirt to take!

But how to get it? This was before the day of flash bulbs, and the judge had forbidden the use of flash powder anywhere in the court building. A time exposure was my only hope.

Covering the camera with my hat, I placed it on the counter opposite the juror and the lawyer. When the woman began to speak, I raised the hat and opened the shutter. Then I counted the seconds. As I reached 14, the attorney moved. I closed the shutter.

Even with a 14-second exposure, the negative was underexposed. But intensification brought it up so a print could be made. This was delivered to the state's attorney.

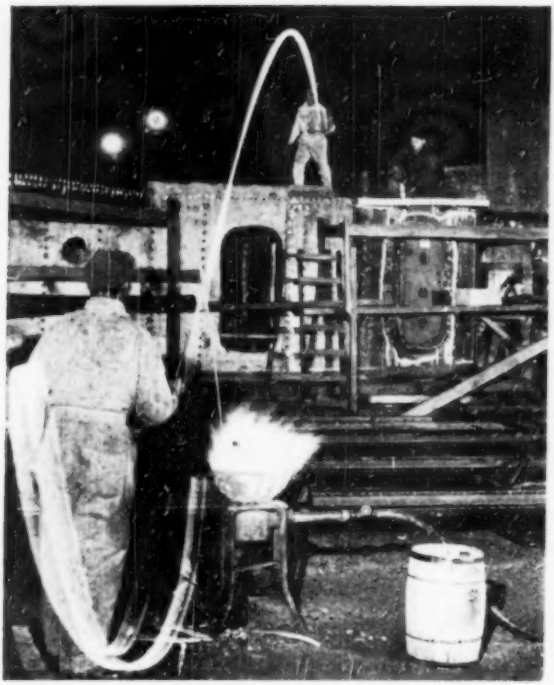
As a result, the woman was excused from

Attorney and juror chat during Snook murder trial in 1929—an early example of a "candid photo." A 14-second time exposure, the photo was taken with a 10- by 15-cm. Ica camera set at f/4.5. The negative was made on glass plate. When the court later saw the picture, woman was excused from serving on the jury.

Brenda rests after her debut. Cameramen were banned from Brenda Frazier's debut but Costa went anyway—with his camera concealed. Tired out from hours of dancing, the young lady finally sat down with an arm around a companion, long enough for Costa to focus his Zeiss Contax and make a 1-second exposure at f/1.5.

Close-up of Liberty. Costa snapped this from a helicopter hovering less than 100 feet from statue. To bring face up closer, he used a telephoto lens on his Speed Graphic. Exposure was 1/160 second at f/11. (This photo from King Features. All others copyright by New York Daily News.)

"Life in the Deadpan." Photo was given this title because no one had previously seen Joe Louis wear such a scowl. It shows him delivering K.O. to Arturo Godoy. This was one of the first successful fight shots made with high-speed lights. Exposure 1/200 second at f/16.



Riveters at work. A combination of flash and time exposure, this photo was shot during the war to show how riveting teams work in a shipyard. With the scene in total darkness, Costa opened his shutter and "heater" in foreground tonged a white-hot rivet from fire and threw it to the "catcher." As latter caught rivet, Costa shot his flash and then closed shutter.

the jury. The judge announced that she and the attorney had been neighbors during childhood, but had not recognized each other during the preliminary questioning.

This friendship, if discovered later, could have caused a mistrial—after a lot of the state's money had been spent.

Such lucky breaks in getting pictures don't come often. To get good news photos, you can't depend on luck.

Take Brenda Frazier's debut, for example. For nearly two years she had been publicized as the "glamour deb." Then, it was announced that no photographers would be permitted at her coming-out party. To the editor of a picture-minded newspaper, that's always a challenge.

I drew the assignment of crashing the party. That wasn't too difficult. Once in, I spotted several other New York press photographers—also in disguise.

From a photographic standpoint, things looked bad. In a ballroom, the lighting is usually soft and romantic, rather than brilliant and photographic. This one was no exception.

Because of the poor light, the photographers agreed that we should try for posed pictures. I was picked to ask Miss Frazier.

Dancing was in full swing. To reach her, I got into the stag line. When my turn finally came, I told her, feigning some surprise, that the news cameramen had gotten in—just like in the movies. I asked her if she wouldn't pose. She barely had time to exclaim "Oh, dear no! Mother wouldn't let me!" when the next man in the line was tapping my shoulder.

After this attempt, the other cameramen gave up, one by one, as the night wore on. The young lady continued to dance—but at last, about 5 a.m., she finally sat down. For

Chauffeur. While King George and Queen Elizabeth were visiting Hyde Park, President Roosevelt drove them around estate himself. Costa shot this flash picture as the car sped by, panning his camera to help stop motion of the car.

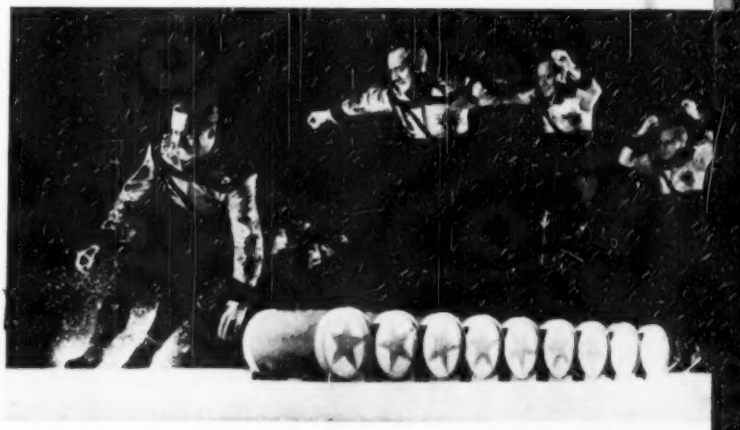
"Wolf Pack." The expressions on faces of the Marines below give you a clue to the title of the picture. Costa shot it, 1/200 second at f/16, when several models visited the Marine base at Quantico.

the first time she was still long enough for an exposure that the poor light and my best lens demanded. I shot from a balcony.

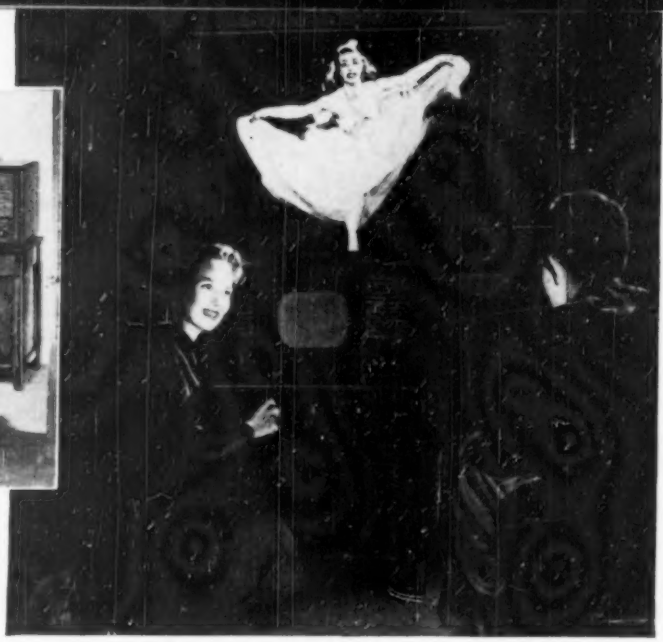
The picture of Joe Louis delivering the K.O. to Arturo Godoy helped make prizefight as well as photographic history.

It was one of the first successful applications of multiple high-speed strobe lights to fight photography, a technique almost always used now at fights. Three lights were mounted in the framework above the ring, placed to give good cross lighting. A snap-switch attached to the camera shutter controlled the lights.

The picture was titled "Life in the Deadpan." Until it was taken, Louis had always been dubbed "dead-panned." But pictures, like figures, don't lie. END



Skater jumped four times and Costa made four separate exposures on one sheet of film for this unusual photo. With his Graphic flat on the ice, he put black drape behind the barrels. Split-second timing with high-speed strobe light made the exposures. For the first one, Costa flashed the light as the skater rose on his toes for the jump. Second exposure, made on second jump, caught skater with legs up to clear barrels. The third and fourth exposures caught him in later phases of next jumps.



Switching from direct to projected view takes only a minute. Small screen is blank when unit concealed in cabinet is being used to provide large picture.

New Unit Adds TV Projection To Your Set

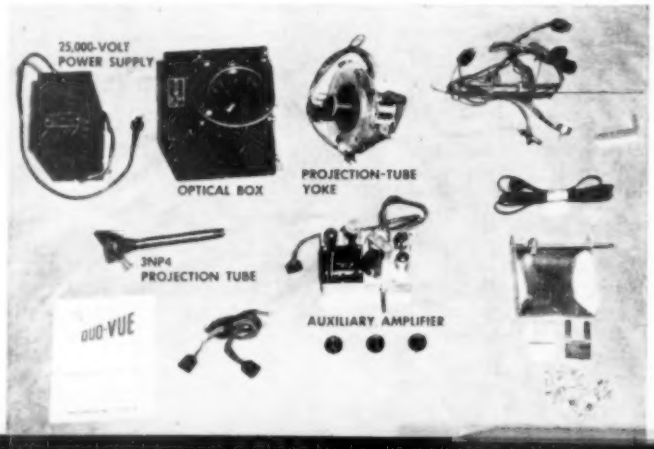
Plugged into a small direct-view set, this compact device throws the picture onto a home-movie screen.

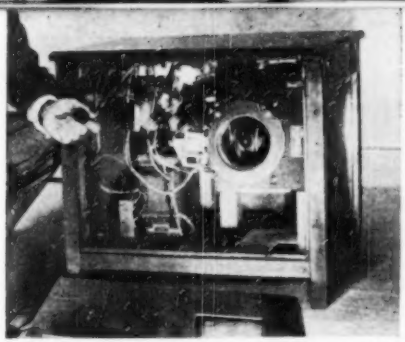
BY PLACING a 10" table-model teleset on a table now available, you can turn it into a projector that will throw a 3 by 4 foot picture. When you're alone, you can watch the small screen as usual. When the neighbors barge in, you can flick a switch, unroll a home-movie screen, and thus convert the living room into a theater.

The table contains a Protelegram projection system (PS, Aug. '49, p. 100) such as is used in many regular projection sets. It's made by the North American Philips Co. and sells for about $200.

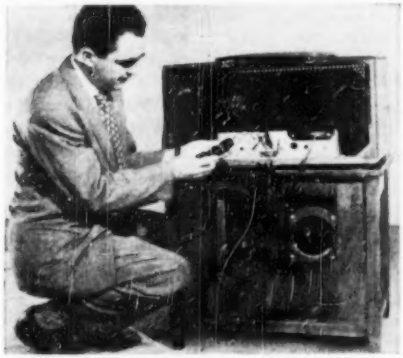
Prewired plugs connect this projection unit to a standard TV receiver after it has been wired to receive them. This can be done in an hour or so by anyone who can repair a radio. Pulling these plugs and inserting shorting plugs restores connections in the original direct-view set's circuit.

What's inside the conversion table is shown at the right. These parts are assembled in 20" by 26" table 23½" high. Picture is projected from 2½" 3NP4 tube. High-voltage unit is only 4½" by 7" by 8½". Parts, including connecting wires and hardware, come assembled in table as shown on next page. Maker provides connection instructions.



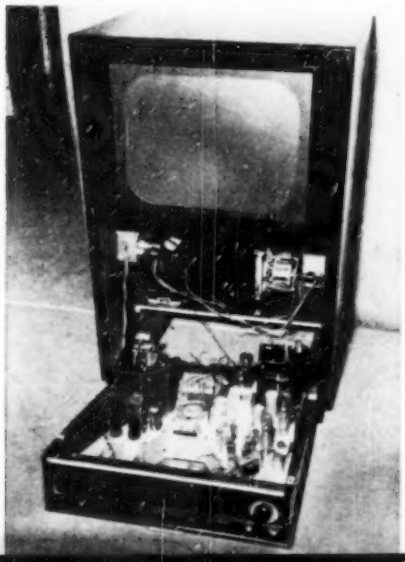


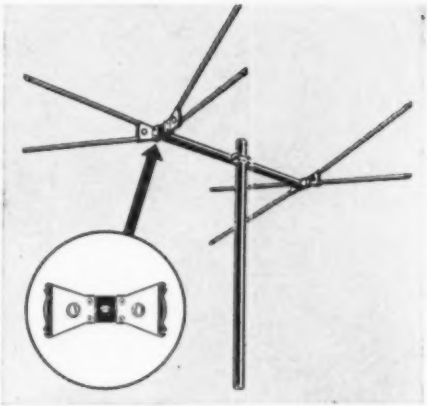
This is the rear of the table shown on the facing page. It has concealed rollers so that it can be moved away from the wall when this unit is used to project pictures.



Almost any standard 10" or larger receiver can be used with the projection unit. Connections, which are keyed in instructions, go to two sockets, one with 11 prongs, another with 6.

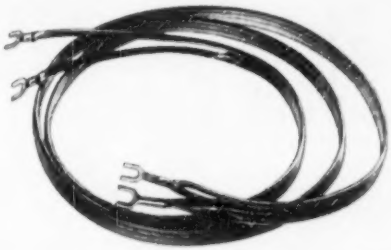
Another, different Protelgram system costing $275 (below) uses your old set to create 13½" by 18" picture on built-in projection screen. Direct-view tube is removed and new parts put in.





Aerial Has Lightning Arrester

PROTECTION against lightning and static charges is built into this new TV antenna. The arrester is molded directly into the plastic insulator that joins the antenna elements. Installation follows the usual pattern except that the mast must be grounded. The arrester is incorporated in a new line of conical antennas made by JFD Manufacturing Co., Brooklyn, N. Y.



Transformer Made of Lead-in

MISMATCHING of terminal impedances of TV antennas, lead-ins, and receivers is one of the major causes of poor reception. Mismatched lines reduce the efficiency of signal transfer and therefore prevent the full signal at the antenna from reaching the set. Some of the loss can be recaptured through the use of transformers. A simplified but efficient model is shown here. It consists of a length of 4-conductor flat-ribbon line that transforms a 300-ohm impedance at one end to a 75-ohm impedance at the other. It can be used in either direction. The transformer is a product of American Phenolic Corporation ("Amphenol"), of Chicago.

This loudspeaker takes the place of a kitchen radio. You can build it yourself for a lot less than the cost of a separate receiver.

How to Double the Usefulness of Your Radio

Listen to records or your favorite programs while you work. And if your shop gets noisy, just turn the volume up.

An inexpensive extension speaker with its own volume control will make one set serve as two.

By Henry C. Martin

WOULD you like an extra radio for your workshop, kitchen, den, basement, bedroom, or attic? Here's an easy, inexpensive device to make your present receiver work in two places at once.

It's an extension speaker with a built-in amplifier that allows you to control volume independently of the master set. If your shop is noisy, you can turn this speaker up without boosting volume at the radio.

You're not limited to radio programs, either, for you can put a stack of records on your upstairs phonograph and let the extension unit play them to you in the basement. The remote amplifier is connected to the main set by low-voltage, two-conductor wire and can be as much as 150 feet away.

Scant Space Required

The simple one-tube amplifier fits easily on a flat sheet of aluminum measuring 3½" by 5½". You can bolt the chassis to the frame of the speaker and mount the entire unit in a small speaker cabinet.

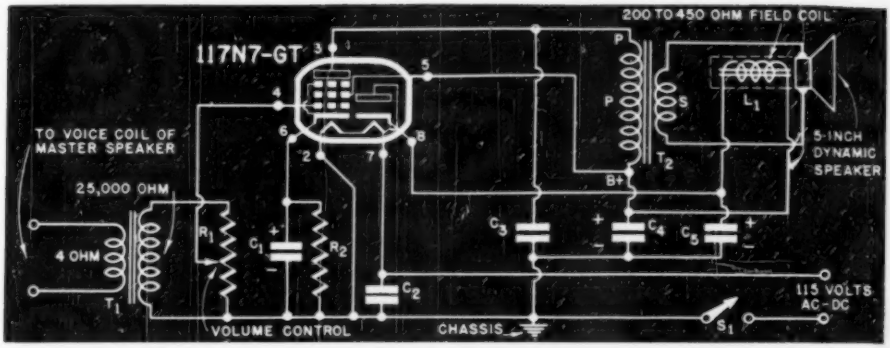
Tapped off the voice coil of the master set, the signal is fed to an intercom transformer. One with a 4-ohm primary winding is specified in the parts list because this impedance provides a fairly close match for the voice-coil impedance of most radio speakers. In wiring the transformer, make sure that both the primary lead and input terminals are well insulated from the chassis.

A volume control across the transformer secondary effectively regulates the signal voltage reaching the grid of the 117N7 pentode. The signal is amplified by the tube and then piped to an output transformer that matches it to a small loudspeaker.

Consider the Cost

Note the term "small loudspeaker." This amplifier has about the same tone and volume as an AC-DC radio, which means that it's good but not in the high-fidelity class.

There's no point, therefore, in using an expensive speaker. When you go shopping for one, look closely at the price tag. You should be able to buy a unit like the one in the pictures here for $2 or less, complete with output transformer. Pick a transformer that has a 2,500 to 3,000-ohm primary.



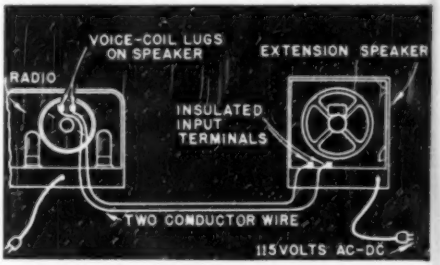
LIST OF PARTS

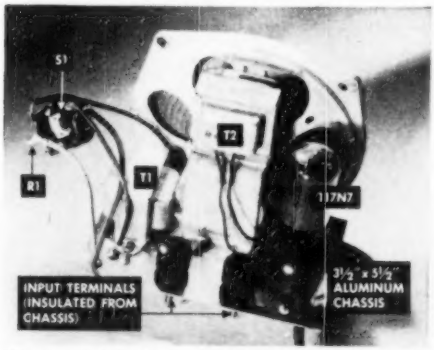
R1: 500,000-ohm volume control.
R2: 270-ohm, ½-watt carbon.
C1: 10-mfd., 25-volt electrolytic.
C2: .01-mfd., 400-volt paper.
C3: .006-mfd., 400-volt paper.
C4, C5: 20-20-mfd., 150-volt dual electrolytic.
T1: Intercom transformer, 4-ohm primary, 25,000-ohm secondary.
T2: Output trans. to match 3,000-ohm load to speaker voice coil.
L1: 450-ohm field coil on dynamic speaker.
S1: SPST switch on R1.
Speaker, 117N7, and socket.

Also, try to get an electrodynamic speaker with a field coil rated at about 450 ohms. A field-coil speaker saves you a little extra money since the coil doubles as a filter choke. If you already have a speaker of the permanent-magnet type in your scrap box, use it by all means. But don't forget to wire in a separate choke coil in place of L1.

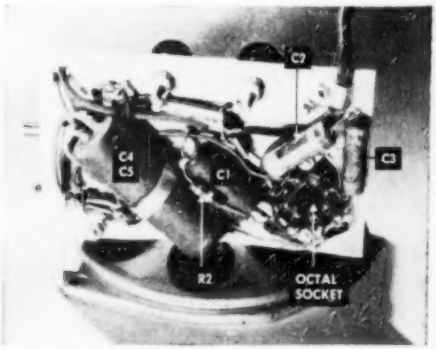
The use of the 117N7 in this amplifier is another economy step. Because it has a 117-volt heater, the tube operates right off the power line and needs no filament transformer. It contains a rectifier diode in addition to the amplifier pentode.

You should find it an easy job to wire up the dozen parts that go into this amplifier speaker. Once you have it assembled, you are ready to connect it to a radio—any radio. Tune in the radio and set the volume at any point from a whisper to full throttle. You can then adjust listening volume at a remote speaker to any level you like. END

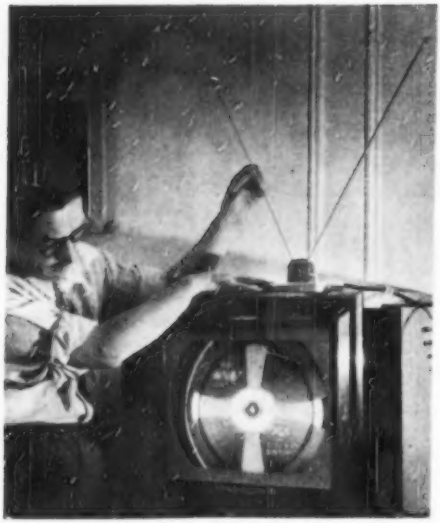




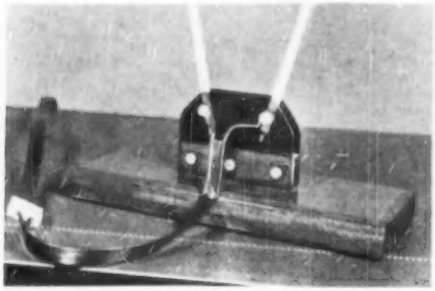
Most speakers have suitable holes, so the small chassis can be screwed directly to the frame. The complete unit fits in a speaker cabinet.



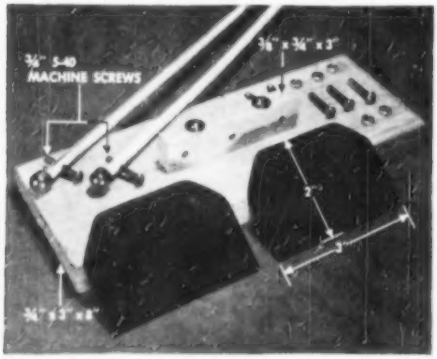
Bottom view shows simple, flat arrangement of the parts. Even a beginner should find it easy to wire this one-tube circuit.



You can adjust the arms of this curtain-rod room antenna in direction, angle, and length.



Use machine screws to clamp the rods between the plastic sides. Draw up on the nuts until the plastic grips the rods lightly.



Holes in the rods should be big enough to clear 5-40 screws. If they aren't, use smaller screws; enlarging holes may weaken rods.

How to Fish For More TV Stations

Curtain rods and lead-in wire can help you overcome antenna troubles.

HAVING TV trouble? It often can be ended for 30 cents. Simple homemade dipoles sometimes lick ghosts, snow, noise, or weak signals.

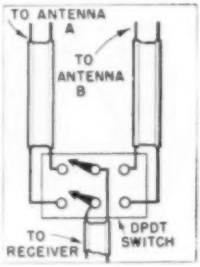
For all-around service an indoor aerial is rarely equal to a good rooftop rig, but in strong-signal areas it may be adequate. Moreover, it may be just what you need to *supplement* another antenna. An indoor antenna can be quickly tuned and oriented to the station you want. If you are having trouble with your present setup, here are three inexpensive rigs that are easy to try.

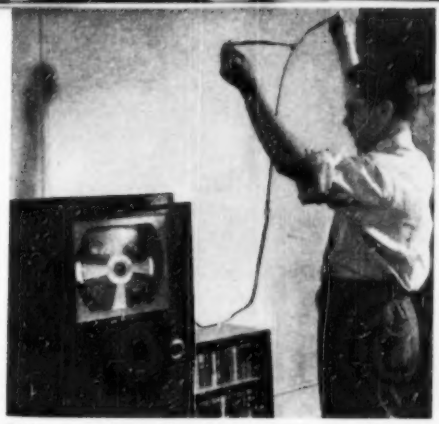
Curtain-rod rabbit ears. You can make a fully adjustable antenna like the one pictured at the left from dime-store curtain rods and scraps of wood and plastic. This one's base is a ¾" by 3" by 8" piece of plywood, and the photos show how it was assembled and connected to a 300-ohm lead-in wire.

This antenna can be rotated until a clear picture is received. Start with the rods in V formation and try moving the arms up and down, and in and out. A little experimenting will show you the best adjustment for each station.

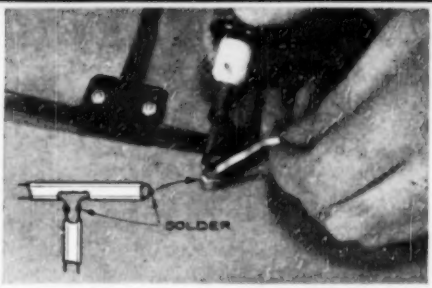
Lead-in wire antenna. If you now

To switch from one antenna to another use the arrangement shown at the right. Connect a length of 300-ohm line from the input terminals on receiver to the center contacts of a DPDT switch. Bring the two antennas to the outer switch terminals. Use an old-fashioned knife switch for best results.





This one-channel antenna may actually surpass a roof antenna. Turn it to face the station.



Soldering the tips of the wire together turns a piece of 300-ohm lead-in into a folded dipole. Try various locations until you find a good one. It may be under a rug (as at right) or behind some furniture.

receive all but one of your local stations, an extra antenna may help you pull in the elusive channel. You can make a tuned dipole from a couple of feet of 300-ohm flat ribbon wire.

The table at the right gives the length suggested for each channel or combination of channels. If, for example, you are trying to improve reception on channel 7, cut a piece of 300-ohm ribbon about 31″ long. Bare the ends of the wire and solder the tips together as shown in the photo. Find the exact center, snip one of the two parallel conductors, and solder another piece of 300-ohm lead-in to the severed leads. To give the assembly extra strength, clamp a couple of pieces of plastic at the point where the lead-in joins the antenna.

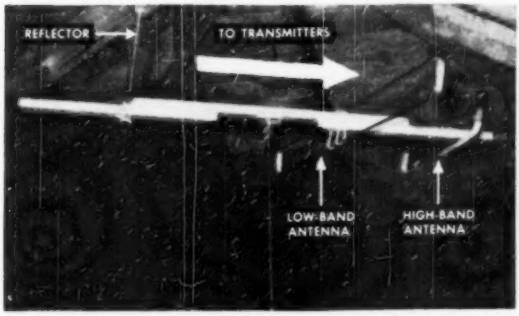
Connect the lead-in to the set and move the antenna around until you find the best location. You may also want to try extending the lead line and carrying the antenna to an upper floor or into a closet.

CHANNEL OR BAND	FREQUENCY (MC)	TOTAL LENGTH OF ARMS (INCHES)
2	54-60	98
3	60-66	88
4	66-72	80
5	76-82	70
6	82-88	65
7	174-180	31
8	180-186	30
9	186-192	29
10	192-198	28
11	198-204	27
12	204-210	26
13	210-216	25
low band (channels 2-6)	54-88	78
high band (channels 7-13)	174-216	28
all band (channels 2-13)	54-216	60 to 65
FM	88-102	56

Curtain-rod trombones. Another type of curtain-rod antenna (below) was built by Edward R. Maki, of Worcester, Mass. He uses it in his attic to pick up Boston stations 40 miles away. Four rods fitted together in the shape of a folded dipole make up the high-band antenna; the low-band unit uses four rods plus an extension strip. The reflector—which is slightly longer than the low-channel dipole—consists of two extension strips fitted together.

The elements shown are tied to a 6′ strip of lumber, pivoted on top of a lamp stand. Separate lead lines connect the antennas to the receiver through a switch. The reflector is of course not connected.

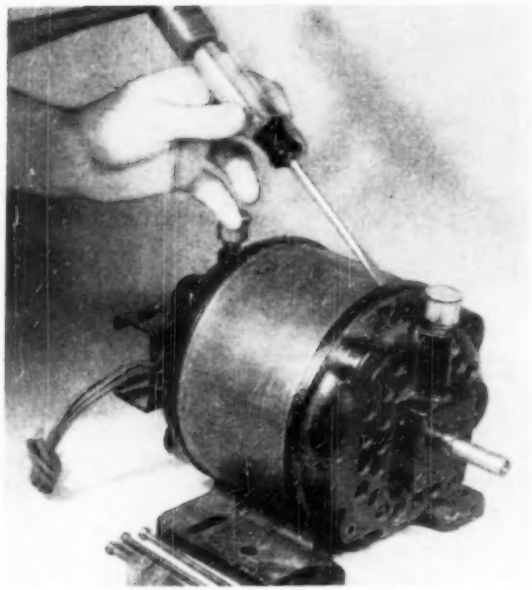
The arms of the low-band attic dipole are somewhat less than the full length suggested in the table. You can find the best length by experimentation. END



Attic antenna is protected from wind and rain, so the dipoles and reflector are simply tied to wooden mount.

Rewind It Yourself

Burned-out motors needn't stump the home electrician who's willing to tackle them.



Mark one end bell so you can reassemble it the same way. Gently tap it off, not only at the top, but all around.

THAT electrical jack of all trades, the fractional-horsepower AC motor, seldom complains until it gives up the ghost. Wisps of smoke and a burned smell are signals of a burned-out winding and a costly repair job—unless you do it yourself.

But you *can* do it, and with no more mathematics than it takes to count to a hundred. Of course connections, wire sizes, and insulation are critical, and should be as much like the original as you can make them. But all the specifications you need are built right into the motor itself. Make it a rule never to break a connection or take anything apart without making a paper-and-pencil record of it first.

The photos show how two typical split-phase motors were rewound. This kind of induction motor has two main parts—a rotor, fixed on the shaft, and a stator inside which the rotor turns. The stator, made of steel stampings (Fig. 1), is wound with wire. There may also be a capacitor, a terminal box inside which connections are made, a centrifugal switch, and an overload protector or cutout switch.

Opening the motor. Start by making a diagram of the terminal box, or of the wires connected to the line cord. If the wires are color-coded, write down the color and where each goes. If the wires all look the same, stick on adhesive tape, letter or number each tape tag, and key these to the sketch.

Now take out the through bolts that hold on the end bells—the rounded housings that cover each end of the motor. Make a prick-punch mark on one end bell and another on the frame to help you reassemble it the same way. Tap lightly all around the end bell and drive it off the frame. Carefully lift and pull out the rotor. Then tap off the other end bell. Again make a sketch of all wire connections and identify leads before cutting them.

Now you can see the windings on the stator. Look closely, and they'll resolve themselves into two sets of coils, one set wound on top of the other. The upper ones are usually the starting winding. The under coils are the running or main winding, and consist of heavier wire.

A burned-out winding will have brittle insulation that looks burned and rubs off between the fingers. Usually it's the starting winding that's burned out, but it's always advisable to rewind both rather than take a chance on the old running winding.

Unless you really intend to rewind the motor yourself, don't remove any windings. It's a big job to calculate winding data without the old windings to go by, and many repair shops will refuse the job.

Removing the old wire. The first step in rewinding is to cut the tape that ties the coils together, and to knock out the wedges holding the coils in the stator slots. You can speed up the job by burning out the

insulation with a torch flame. This won't hurt the stator ring, but it may discolor the paint on the housing.

One of the motors shown is a 1/6-hp., 60-cycle, 1,150-r.p.m., six-pole type. The other is a 3,450-r.p.m. motor having only two poles. Each pole consists of a number of stator teeth (Fig. 1) so wound with one group of coils that they form a single magnetic pole. The six-pole motor shown has six coil groups in the starting winding and a similar number in the running winding. Since it has 36 stator teeth, each coil group embraces six teeth to form one pole. Starting and running windings have separate poles that overlap, sharing some stator slots.

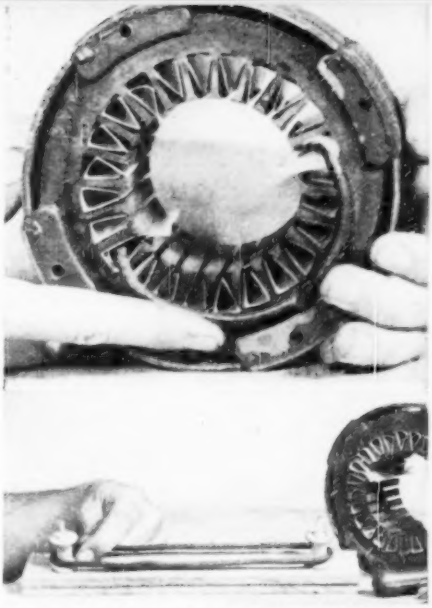
Punch-mark the stator ring at any slot on the side the winding leads come from (you'll want to be able to identify that side) and count the slots, going *counterclockwise* around the stator. Then draw a simple "developed" diagram of the slots—a drawing that shows them as if unrolled and laid out straight, as shown in Fig. 2. Number the spaces representing the slots.

Now carefully remove any convenient coil group of the starting winding. It may consist of two, three, or more coils, each coil being wound in a different pair of slots around a common center. The coils may have the same or a different number of turns. Pull out the outermost coil first, separate the wires so that you can count them, and mark the figure on your diagram as in Fig. 2. It's enough to count all the coils in one group; the other coil groups will be the same.

Having removed all of the starting winding and recorded the start and finish of each coil group, make a second drawing for the running winding, using the same slot numbers. Count the turns of one coil group as before, and diagram all the groups as in Fig. 3.

Check wire size. Measure the bare wire from both windings, either with a standard wire gauge or with a micrometer. To estimate the amount of new wire needed, weigh the old windings, adding a bit for the burned-off insulation.

Figure 2 is the diagram of the starting winding of the 6-pole motor shown. When the outermost coil of one pole winding was removed, it was found to span six stator teeth with 40 turns. The middle coil came off next, spanning four teeth with 60 turns. Finally the innermost coil was unwound from two teeth, and counted 40 turns.



Gauge length of a jig-wound coil by first shaping a heavy wire in the slots to be spanned (top photo). In this two-pole motor, coil spans 12 teeth. Wire showing length is stretched over spools (above) and hole for movable spool is drilled ¼" farther apart. Hold jig as at right to wind coils. As each is finished, hold it below jig while winding next one. Wire is not cut between coils, but left a few inches long to facilitate insertion. Movable spool is respaced for each coil.

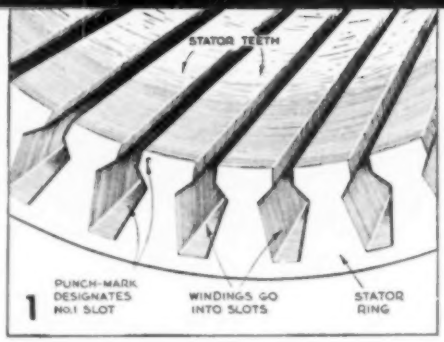
Note that there is an empty slot between the two inside teeth wound with this last coil—empty, that is, of any part of the starting winding, but carrying part of two coils of the running winding.

The wire unwound measured .0253", which a wire-gauge table shows to be No. 22. The running winding was then also unwound and a second diagram made (Fig. 3). Its wire measured .0359", equivalent to No. 19.

Rewinding the stator. Clean out all old insulation first. Then cut new insulation, as in Fig. 4. The slot fillers are made

of .020" fish paper—the standard variety of paper used for electrical insulation—with end folds to keep them in the slots. Cut slot wedges of thicker stock such as .035" fiber, ½" longer than the slots and wide enough to be a drive fit. You can buy wooden slot wedges in standard sizes if you prefer. Finally you need some .015" fish paper or varnished cambric to insulate the two windings from each other. Cut pieces ½" longer than the slots and wide enough to fold over under the wedges. All this material, as well as Formex wire for the windings, can be bought at electrical supply houses or motor-repair shops.

Having put all the slot fillers in, you are ready for the running winding. You can wind it right in the slots, or on a coil jig such as is shown in several photos. The jig consists of two ¾" by 1½" by 12" strips of wood for the sides, two thick nails cut short (or pieces of ¼" dowel) for the axles, and two empty thread spools to wind the wire around. Assemble the jig as shown in the photographs, making one spool movable so



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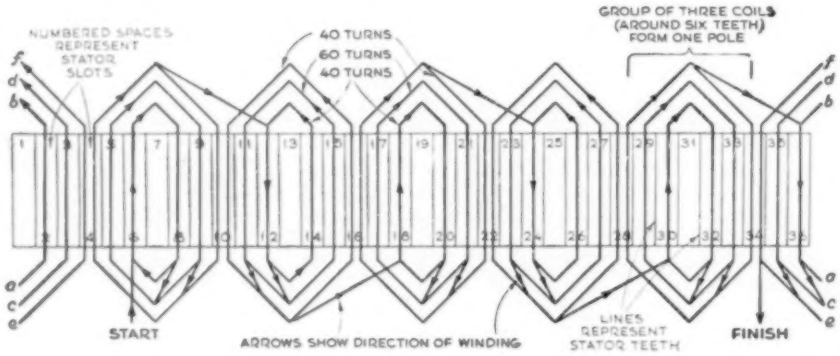
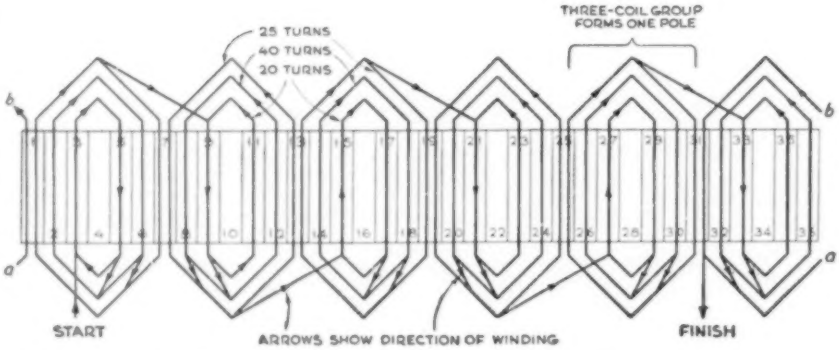


2 STARTING WINDING FOR 36-SLOT, 6-POLE MOTOR



3 RUNNING WINDING FOR 36-SLOT, 6-POLE MOTOR

that the space between spools can be varied according to the size of the coil desired. This size can be found by bending a heavy piece of wire into the stator slots spanned by the coil to be wound, and cutting it to fit. Then pull the wire into a long closed loop over the two spools to mark the position of the second spool in the jig. Drill the hole ¼" farther away to give a little extra margin for overlapping coils.

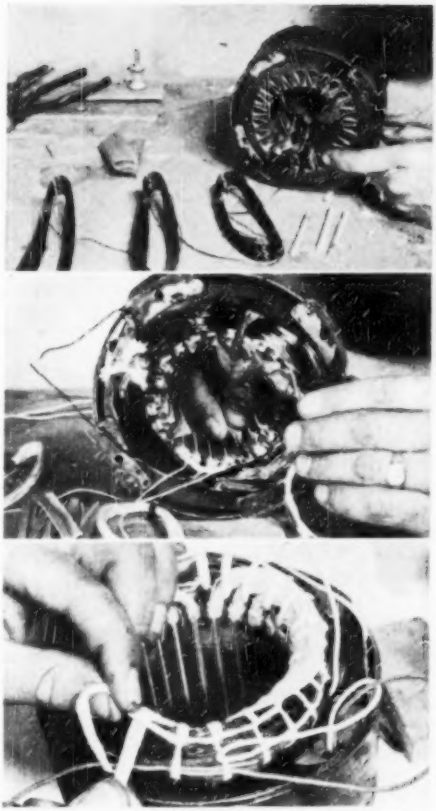
Wind the required number of turns on the jig, remove one wood strip, bind the coil in two places with tape, and pull it off. Then respace the movable spool for the next coil and wind it without cutting the wire, holding the finished coil under the jig. Wind all the coils of a group in the same direction.

When all the coils have been wound, shape them to fit the stator and slip them in. Be sure to keep the lead sides on the proper side of the stator. Place the smallest coil of the group with which the winding starts in its slot first. Usually this is easiest to do by inserting the coil first in the slot that is farther from you (assuming you have the stator before you with the slots running from one hand to the other, as shown in a photo). Secure the first coils temporarily with wedges.

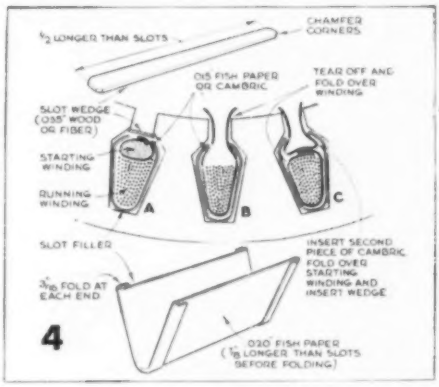
The windings must run the same way in all the coils of one pole. But they run oppositely in the next group, and so on, changing direction from each pole group to the next. To reverse coil direction, simply flip over the coils before inserting them.

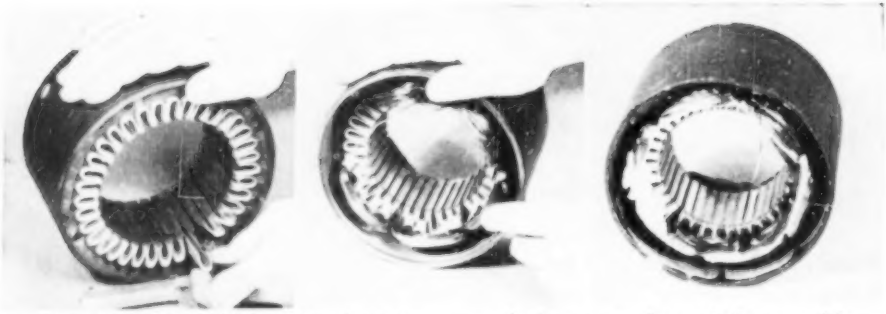
Winding in the slots. The six-pole motor shown was rewound right in the stator slots. The start of the main winding (Fig. 3) consists of 20 turns in slots 3 and 5. The wire is then brought over to slot 2 (at the same side of the stator from which winding was started) and 40 turns are laid in this and slot 6. The last coil consists of 25 turns in slots 1 and 7. The wire isn't cut, but now goes into slot 9, 20 turns being wound in this and slot 11, but *in the opposite direction*. Remember that windings go in opposite directions in adjacent coil groups, but in the same direction in all coils of one pole group.

You can cut the wire between poles if it makes winding easier for you, but be sure to leave enough for a good soldered and taped joint. Connect the coil groups so that the winding reverses direction from pole to pole, or the motor won't run. You can test the winding direction in all the coils



To insert jig-wound coils, hold stator before you as in top photo. Slip wire into farther slot first. Photo shows first coil of running winding being put in. In center photo, main windings of two-pole motor are in and first coil of starting winding has just been inserted. Bind the lead wires and the end loops of both windings with cotton tape as in lower photo.





Inserting slot fillers (left) readies the stator of this six-pole motor for winding. Running coils go in first. At center, five poles have been wound. Tape or cambric is laid over end loops before starting winding is inserted. At right, three of the six starting coils are in.

by connecting the entire winding to a DC source. Hold a pocket compass near each pole in turn. Adjacent poles should attract opposite ends of the needle.

The starting winding. Lay strips of wide cotton tape along the end loops of the running winding to further insulate it from the starting winding. As the diagrams show, its coils lie right between the coils of the running winding.

Remove any temporary wedges from slots partly wound and insert pieces of .015" fish paper or cambric wide enough to fold in over the starting winding, as shown at A in Fig. 4. Wind in the starting coils according to your diagram, inserting slot wedges as each is completed. If a wedge is loose, drive in another on top of it.

Some repairmen prefer to cut the insulation as shown at B in Fig. 4. A piece of cambric long enough to stick up from the slot is inserted over the slot filler. The projecting ends make it easier to feed the wire in, and protect it from the edge of the slot. When the running coil is in, the cambric is torn off at the top of the slot and folded over the wire. Then a second piece is laid in as at C, Fig. 4, and the starting coil is wound on top of this, in turn being torn off and tucked in. The wedge then secures everything.

It's a good idea to check coil direction for the starting winding too, and to test both windings for possible grounds to the stator ring. If you find a ground, don't go any further until you correct it.

Assembling the motor. Solder heavy lead wires protected by heat-resistant braid to the coil ends, and tape all connections carefully. Then bind all the end loops firmly with cotton tape.

The stators of first-quality, heavy-duty motors are dipped in insulating varnish and baked after winding, but the average refrigerator, workshop, and oil-burner motor designed for intermittent service is rarely so treated. You can forget about baking if yours is this kind. Otherwise, you can take the stator to a shop specializing in motor work and have it dipped and baked.

Clean the contacts of the centrifugal switch, making sure it works freely and its springs are in place. Also make certain that the rotor turns freely in its bearings and doesn't rub the windings at any point. Lubricate the bearings, and the motor is ready to try out.

Troubleshooting. If the rewound motor runs fine, but the wrong way, all you need change is the relative connections of the two windings. Reverse the leads of either the starting winding or the running winding, but not both.

If the motor doesn't even hum, look for an open circuit. Maybe the overload relay is open and has to be reset.

Should the motor hum but not run, disconnect it at once and look for an open connection to one winding, a bad capacitor, or a defective centrifugal switch. If both windings are receiving current, your trouble is probably wrong coil polarity.

An effort to start, accompanied by humming, overheating, insufficient speed, or other signs of distress, may mean a defective centrifugal switch or wrong coil polarity. Never leave a motor connected if it doesn't come up to speed properly.

When the motor starts quickly and settles to quiet, smooth running with no sign of overheating or roughness, you can wrap it up as a successful job. END

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NICHOLSON FILES *FOR EVERY PURPOSE*

Gus and the Gas-Hungry Milk Trucks
[*Continued from page 194*]

Milk Co.," embroidered in red across the back. He felt more like a milkman than a mechanic as he strolled toward the service shop.

"Well, if it isn't Gus Wilson!" came a loud greeting. "The boss said you'd be over to solve all our problems."

Gus turned his head and recognized Jack MacDonald, the day service foreman. "Jack hasn't changed much—cocky as ever," he thought as he acknowledged the greeting with a handshake.

"Sure hope you can straighten things out, Gus, and get my boys in on that bonus money."

"I'll try, Jack. Now, if . . ."

"Try?" broke in Jack. "I've tried just about everything. Even sort of spied around a little to see if Pocheck's crew had thought up any new service angles."

"And had they?" asked Gus.

"Nope. I just don't get it. Both our shifts use exactly the same maintenance schedules. Come on over to the office and I'll show you what I mean."

As they walked across the shop floor, Gus noticed that the equipment was all of the best. The place was a garageman's dream. As modern as 1950.

Service Schedule Meets Gus's Approval

Once inside the office, MacDonald pulled out a desk drawer, picked up a mimeographed booklet, and handed it to Gus.

"There's our service schedule. Pocheck's crew and mine follow it right to the letter."

Gus fingered through the pages. He had to admit it was a complete schedule and he said so.

"Thanks," Jack grinned. "We modeled it after the preventive maintenance plan used for government cars and trucks. It doesn't leave a thing to the imagination. Tells you not only when to make the various checks, but just how to make them. Any grease monkey can follow it if he can read."

"How often do you check wheel alignment?" asked Gus.

Jack licked his thumb and flipped the book open to page 10.

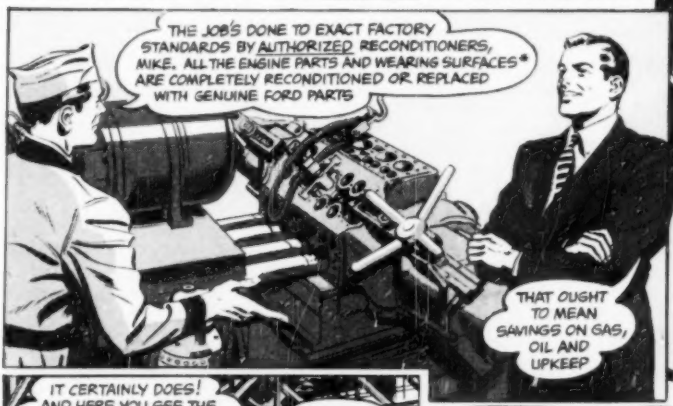
"There it is, item 24 under the 4,000-mile check. Now, on page six of Appendix B you'll find a list of the exact steps to be followed in making the check and how adjustments should be made. There's no

[*Continued on page 248*]

"They showed me", says Mike
(FROM MISSOURI)

"How to give my faithful Ford a new future!"

WHEN I VISITED ONE OF THE FORD-AUTHORIZED RECONDITIONING PLANTS



*CRANKSHAFTS, CAMSHAFT, BUSHINGS, VALVE GUIDES, TIMING GEARS, PISTONS, RINGS, BEARINGS, RODS, VALVES, GASKETS, STUDS, NUTS —ALL COMPLETELY RECONDITIONED OR REPLACED WITH THE PARTS THAT ARE MADE RIGHT, FIT RIGHT, LAST LONGER.... GENUINE FORD PARTS

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SHOPSMITH has precision features found only in highest priced saws, drill presses, lathes and sanders. Four grease-sealed ball bearings in headstock. Induction hardened spindle tip. Centerless ground steel ways. Built-in quality through and through. So compact it fits any 2' x 5' space. So ingeniously engineered you can convert from tool to tool *in less than 60 seconds*.

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complete except for motor. With special ½-hp., ball-bearing, capacitor-type motor (*shown*) **$199.50**

SHOP SMITH

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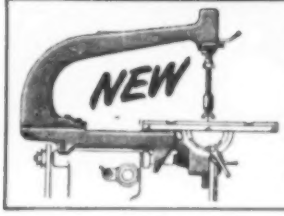

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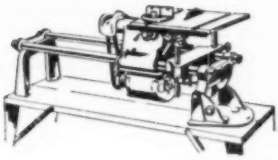
Heavy-duty, precision construction. 18" throat. Tilting table. Built-in blower. Attaches quickly. Price complete..... $34.50

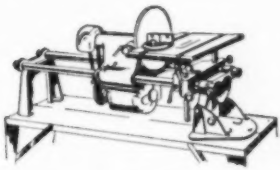
1. 8" CIRCULAR SAW



SHOPSMITH saw has capacity and performance equal to or greater than most cabinet shop models. Can cut to center of 8' plywood panels. Effective table width up to 56". Depth

of cut 2¼". Sturdy tilting table with ball-crank raiser for precise settings. Precision-tooled miter gauge and self-aligning rip fence.

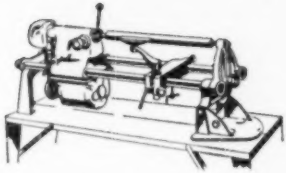
2. 12" DISC SANDER



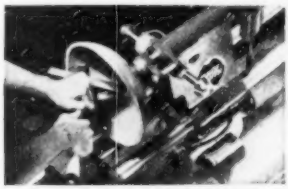
With extendable quill, 12" cast-aluminum disc can be fed into workpiece for safety and accuracy. Extra-large adjustable table measures 14½" x 17". Use miter gauge for accurate

squaring and mitering; rip fence for super-smooth jointing; tilting table for compound-angle sanding. Operator can face work or work from side.

3. 33" WOOD LATHE

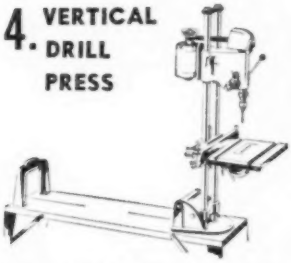


Greater capacity than most other heavy-duty lathes. 15" swing. 33" between centers. 4" quill feed. Swivel-arm tool rest always parallel to ways —no need for constant adjusting.

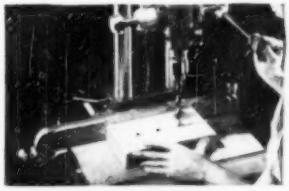


Quickly adaptable for face plate work. Fine-grain cast-iron headstock slides with fingertip pressure, locks in any position.

4. VERTICAL DRILL PRESS

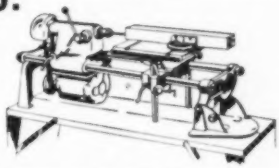


SHOPSMITH drills to center of 15" circle, has a maximum clearance table to chuck of 27", floor to chuck of 55". Jacobs key chuck takes straight shank drills from 5/64" to ½" diameter.

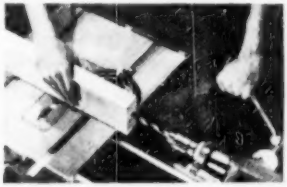


Rugged, 6-spline spindle floats on 4 lifelong, grease-sealed ball bearings. 4" quill feed. Lever fits either side of driving head for right- or left-hand operation. Speeds from 875 to 3500 rpm. Use with or without fence.

5. HORIZONTAL DRILL



Extremely useful operation possible only with SHOPSMITH. Quill feed up to 4" with adjustable stops. Permits large, heavy pieces to be drilled or mortised quickly, accurately. Handy,



too, for doweling tops for tables. Miter gauge and fence eliminate need for jigs. 36" effective table support. Length of work limited only by size of room.

SHOPSMITH TAKES ALL STANDARD ACCESSORIES

Fact-packed, 16-page illustrated booklet. Send for it!

Address:

SHOPSMITH, Dept. 143-A, *at factory nearest you:*

12819 Coit Rd., Cleveland 8, Ohio, *OR*
417 Montgomery St., San Francisco, Calif.

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Address _____

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THAT MUCK

—not in my car?

YES, mister, two pounds of the horrible stuff. After 5,000 miles, that's about average. But your repair bills may be way above average—if you don't get a new PUROLATOR Refill for your oil filter—quick!

If you've been neglecting to have your oil filter checked, chances are there's horrible muck like this in your car. So when you change your oil this fall, start fresh with a *new filter refill*.

Be sure you get a Purolator* Refill—the accordion type that filters more *completely*, hence saves more substantially on repair bills. Costs only $1.38 to $3.00, depending on make of car. Inserted in a few minutes.

P. S. If your car has no oil filter, a *complete* Purolator, *both* housing and refill, costs only $6.50 or a bit more, depending on make of car. Purolator Products, Inc., Rahway, N. J., and Toronto, Ontario, Canada.

Purolator

MICRONIC OIL FILTER

*Reg. U. S. Pat. Off.

Gus and the Gas-Hungry Milk Trucks

[*continued from page 244*]

guesswork and no need for thinking; it's all right there . . ."

Maybe that's the trouble, Gus thought as Jack rambled on. Gus had learned that working strictly by the book wasn't always the best way. He knew by long experience that sometimes a little independent thinking, plus a little imagination, were mighty important when it came to smoking out what ailed a car.

"Mind if I mosey around by myself?" he asked.

"Go right ahead. Help yourself. Do any checking you want. And if you want anything, just holler."

For the next hour or so, Gus watched the three mechanics work on the parked trucks and did a little spot checking on his own. He tested the wheel alignment on one truck, checked the timing and carburetor adjustment on another, and looked for possible brake drag on a third. He even pitched in and helped one of the men change a tire. By two o'clock in the afternoon, Gus decided he was a long way from uncovering a solution to Ed Nealy's problem. The men in the shop seemed to know their jobs, and the trucks he'd personally checked seemed to be in good shape. But he wasn't satisfied. He knew he had missed something some place that made a vital difference.

A Study Period Brings a Question

When Jack MacDonald returned to the service office just before four o'clock—quitting time for the day crew—he found Gus seated at the desk busily poring over the maintenance manual.

"I've been going over your service book," he said, looking up. "Seems to cover the ground, except one point."

"What's that?" Jack asked indignantly.

"There's no mention of daily servicing. You know, gas, oil, water, and air. Do you have any set time for those?"

"Oh, that's routine. All the trucks get their daily servicing every morning. We've overlapped the day and night shifts to take care of that. As each night truck comes in, it's gassed, and oil, water, and tire pressures checked. The same goes for each day truck as it goes out. Simpler that way. Less chance for a slip-up."

"Could be," Gus replied as he pulled himself up out of the chair and headed for

[*Continued on page 250*]

CORALOX is AC's patented spark plug Insulator. It gives you that "something extra" which is always vital to outstanding performance.

CORALOX gives you many extras. It has 4 times greater heat conductivity—10 times greater electrical resistance at high temperatures—is 3 times stronger—than the best ceramic insulator material in use before *CORALOX*.

What do these extras mean in terms of service to you? Easier starting—better idling—no misfiring under heavy loads—no failure due to heat shock—little or no accumulation of combustion deposits.

For better year-round performance in your car, truck or tractor, use AC Spark Plugs with patented *CORALOX* Insulator.

PATENTED *CORALOX*

INSULATOR

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION • FLINT 2, MICHIGAN

Outstanding NEW VALUE!

High on looks . . . low in price — you'll like this new Millers Falls Ratchet Brace with head and handle of glossy red *unbreakable* "TENITE"

It's the new No. 1950 — latest addition to Millers Falls famous line of fine braces. Jaws of forged steel and rugged ratchet mechanism assure long service. Ball bearing head gives smooth, easy operation. Heavy nickel finish keeps it shining. Best of all — it's Millers Falls quality throughout and priced at only $4.50.* See it soon at your hardware dealer's. In looks, in performance, in price — it's the biggest bit brace value on the market.

*Price slightly higher in the West

MILLERS FALLS TOOLS

SINCE 1868

MILLERS FALLS COMPANY GREENFIELD MASS.

Gas and the Gas-Hungry Milk Trucks

[*Continued from page 248*]

the office door. "Can you hang around for a few minutes? I won't be long."

When Gus returned 10 minutes later, he had a tire gauge in his hand and a broad smile on his face. "It may be simpler your way," he grinned, "but it sure ain't efficient."

"What do you mean?" Jack asked.

"Just this." Gus waggled the tire gauge as he spoke. "Not a single one of your trucks on that whole floor out there has a tire that's up to the recommended pressure."

"That's impossible," blustered Jack. "We checked the tires on everyone of those trucks this morning when they came in."

"That's just it," said Gus. "You did check them this morning, just as you do every morning. And I've a hunch that's the cause of your troubles."

"I don't get it." Jack was puzzled "What's the catch?" he asked.

Explanation Is Hot Air

"It all boils down to the fact that air expands when it's heated," Gus explained. "You've been checking the tires of your trucks every morning when they're hot after a night's run. Even if they are up to pressure when you check them, or after you've put air in them, they probably are four or five pounds under pressure by the time they cool off.

"Pocheck's crew, on the other hand, have been checking their tires when they are cool after a night in the garage. On the average, Pocheck's tires have probably been slightly over-inflated while yours have been under-inflated."

"Say, that does add up," admitted Jack.

"Sure, son, it adds up to more tire wear and less gasoline mileage on your trucks. A lot of motorists don't take into account that recommended tire pressures are for cool tires, not for tires that have been pounding the roads and heated up."

A couple of weeks later, back in the Model Garage, Gus had just about forgotten about his trip to the city and his two-day job at the milk company when a short letter arrived in the mail. It read:

"Dear Gus,

Gas mileage up already. The whole day crew is looking forward to sharing the January 1 bonus with you. And that's not hot air. Thanks a million."

It was signed "Jack MacDonald." END

Delta long-life *quality* features:

- Pre-loaded ball bearings.
- Precision-ground arbor.
- Precision-bored bearing seats.
- Ball bearings are lubricated for life.

No. 34-405

$234.00

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Motor and switch extra

Low down-payments, easy terms

Delta is the *complete* line: 53 machines — 246 models. Over 1300 accessories. Plus a complete line of 14 Homecraft® machines.

DELTA MILWAUKEE®

More saw for the money!

Compare what you get!

- ✓ Double-faced rip fence — locks front and back.
- ✓ Exclusive Auto-set miter gage.
- ✓ 5/8" arbor.
- ✓ Diameter of saw blade, 10".
- ✓ Blade tilts 45°.
- ✓ Cross-cut capacity, 12".
- ✓ 3-belt Texrope drive.
- ✓ Graduated front guide bar.
- ✓ Fence can be used on either side of blade.

Famous Delta Unisaw®

Compare this rugged 10" tilting-arbor saw alongside *any* saw *anywhere near* its price. Then you can see why the Delta Unisaw is first choice of schools, industry, commercial shops, home shops.

It's got big capacity — rips to center of 50" panel, cuts stock up to 3 1/8" thick. It has heavily-ribbed cast-iron table, 36" x 27", with ground surface; massive, smooth-operating trunnions; steel cabinet base. It's safe and convenient — has saw guard that really protects . . . fast, handy controls.

See the Delta Unisaw in operation today. See why it's more saw for the money.

Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

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Prepares for Finish . . . Sands uniformly smooth, fine surface. No waves. Levels perfectly. Cleans blemishes.

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Guild A-2 Sander has the speed that gets the job done *fast*. Its power relieves operators from "bearing down" for efficient cutting. Its lightness and balance insure effortless handling, in any position. High speed abrasive belts have grits for wood, composition, plastics, metal, glass. Gives a smooth, straight-grain finish – no swirls, no gouges. Takes off paint and varnish in a jiffy – without scraper or messy removers. An easy-to-adjust Bench Stand (extra) converts Guild A-2 Sander into a grinder for tools and knives – also into a machine for squaring, rounding, smoothing butt and mitre joints. See Guild Sander at your hardware or tool supply dealers today – or send in coupon below.

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☐ SAWS (3 sizes) ☐ PLANE ☐ ROUTER ☐ COMBO-TOOL

Send me literature on the Guild A-2 Sander, also on tool(s) checked above. Also name of my nearest dealer.

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2309 N. Salina St., Syracuse, N. Y.

Mechanics of Farming

By Ladd Haystead

■ When a piece of equipment doesn't do the job as they think it should be done, American farmers traditionally noodle up their own version. Take custom operator A. A. Fritz, of La Crosse, Kans. Believing that

the average combine is too short-waisted--not long enough separating space--he took an old machine, mixed in some odds and ends of truck parts, added new airplane tires--and came up with the behemoth pictured above. A 100-hp. engine operates the four-wheel drive; a second one of 140 h.p. provides internal power. Fritz claims the machine can thresh 3,000 bushels a day with only two men working. The cutter bar is divided so that one side can work high ground while the other is working low ground.

■ The chemical war against orchard pests is advanced with a new Du Pont killer of mites, named EPN, that is said to be effective against the most destructive species and affords protection against reinfestation for several weeks.

■ Tree farming, scarcely known a few years ago, has become big business. American Forest Products Industries announces that there are now 2,332 such farms in the U.S. with over 20 million acres.

■ Since the end of the war, the increase in the use of aluminum on the farm has exceeded 700 million pounds. Now Reynolds Farm Institute (Box 1800, Louisville, Ky.) has issued a manual, "Aluminum for Farm Structures," that gives data on the proper use of aluminum for live-

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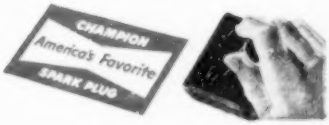
For Over a Quarter Century

BE A CHAMPION DRIVER

. . . It's Schooltime Again—Be Extra Cautious!

"School" signs call for extra caution. Stop for children boarding or unloading from school buses; watch for them getting in or out of private cars, crossing streets!

Obey Safety Patrol boys. These youngsters save hundreds of lives and shoulder a great responsibility. They need your cooperation in observing signals.



Safe driving depends in great measure on a quick, responsive engine. That's why champion drivers everywhere have stamped Champion as America's Favorite!

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network

You Can Apply YOUR UPSON CEILING

RE-COVER UNSAFE AND UNSIGHTLY CRACKED CEILINGS WITH

UPSON KUVER-KRAK PANELS

FOLLOW THESE SIMPLE STEPS TO NEW HOME BEAUTY!

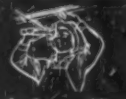
No need to suffer an ordeal of house-cleaning caused by re-plastering. *In a matter of hours,* you can apply a modern characterful Upson ceiling that will be forever crackproof. Pebbled surface matches walls perfectly—takes paint beautifully. No visible face nailing. Amazing Upson Floating Fasteners anchor Upson Ceilings securely from back.

Hundreds of thousands now installed. *Mail 10c now for 32-page Idea Booklet and free detailed instruction sheet.*

1 Nail furring on 16" centers, right over old plaster.

2 Nail Upson Fasteners to furring strips, 8" apart.

3 Clinch Fasteners. See Direction Sheet for simple method.



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738 Upson Point, Lockport, N. Y.

I enclose 10c for your 32-page Idea Booklet and free detailed Instruction Sheet for applying Upson Ceilings.

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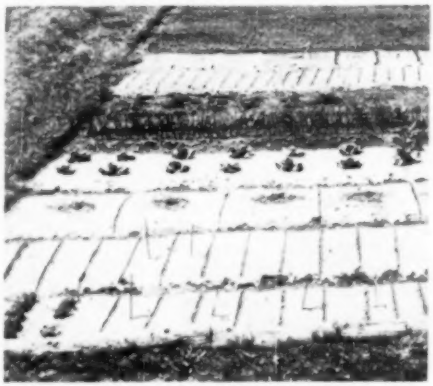
stock barns, storage, poultry and hog houses, and farm homes.

■ In the past 30 years, the gasoline engine has released 62 million acres from raising horse feed to producing food for humans. This is roughly one-sixth of our cropland.

■ Plastic irrigation pipe that can be curved around corners and conform to ground contours is announced by Carter Products Corp., Cleveland. It comes up to six inches in diameter and is said to resist corrosion and to expand to prevent damage by freezing.

■ Plow-sharpening may be outmoded by a replaceable cutting attachment announced by Farmers Tool and Equipment Co., Emeryville, Calif. The unit slips over the point and wedges over the heel of the share, held by spring-grip fingers. It is said to resist abrasion better than the average plowshare and outlast usual sharpenings.

■ How to retain soil moisture and control weed population are perennial problems that have never been completely solved. Now comes a new machine, the Agromulcher, made by Wandel Industries, Downington, Pa., that may be the answer. The machine grinds up 50 pounds of old newspapers, leaves, or any other mulching material in 150 gallons of



water, which puts the chemical and mineral contents into suspension. This material is poured on the land and hardens, excluding sun and weeds. Plants grow through slots (see photo).

Never before - SO MUCH SAW for SO LITTLE MONEY!

Completely NEW

DURO

8" Ball Bearing TILT ARBOR Saw

Only $43.95

C3013—New 8" Tilt Arbor Bench Model saw. With motor pulley, V-belt and 8" comb. blade. Less extensions, switch and motor, $43.95 retail.

CG-3013—New 8" Tilt Arbor Bench Model saw with cast iron grilled extensions, as shown. With motor pulley, V-belt, 8" comb. blade. Less motor and switch . . . $49.95

AS EASY TO BUY AS IT IS TO USE!

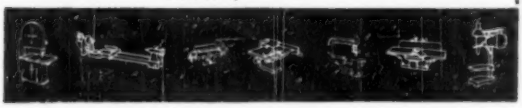
Today's Greatest Saw Value

Now you can enjoy the thrill of working with a husky, extra-capacity *tilting arbor design* saw . . . for little more than you'd expect to pay for an ordinary table saw! This smooth-running new ball bearing saw is BIG in everything but price. There is a full 7⅜" ahead of the blade . . . you can make cuts up to 2⅜" in depth. With grilled extensions the work table measures 26" x 17⅛"—large enough to make big cuts with ease. The new Duro arbor lock tilts and locks the blade just where you want it . . . instantly, safely.

There is a full line of Duro Precision Power Tools *including band saws, lathes, sanders, shapers, jointers, jig saws and drill presses. See them at your dealer.*

DURO Nationally Advertised POWER TOOLS

WRITE TODAY for details and specifications on this new Duro 8" Tilt Arbor Saw. Or, if you would like to order and your dealer cannot supply you, send check or money order for $43.95 or $49.95 and your saw will be shipped prepaid promptly. (Illinois shipments, add 2% Retail Sales Tax.)



EXCLUSIVE NEW DURO MOTOR PULLEY

This new Duro tilting arbor design saw features an exclusive "wide range" motor pulley which allows the belt to adjust itself to the angle of the saw blade. You get more positive drive . . . less belt twist . . . longer belt life. In addition, an interchangeable sleeve permits use of this new pulley on either ½" or ⅝" motor shafts.

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Please send me: Full details about the new Duro 8" Tilt Arbor Saw ☐. I'd like to order a saw right now . . . I enclose check ☐ money order ☐ for $_____

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Need tools for chopping? Or pulling nails, pounding or cutting? Here's one tool that does all these jobs—and more.

Feel its perfect balance in the light and easy swing. The shock-absorbing hickory handle fits snugly in your grip.

The special analysis steel head is expertly made from the long-lasting cutting edge to the tough striking head.

Get a Plumb hatchet and have a time-saving, all-purpose tool handy.

The red handle and the black head —exclusively Plumb

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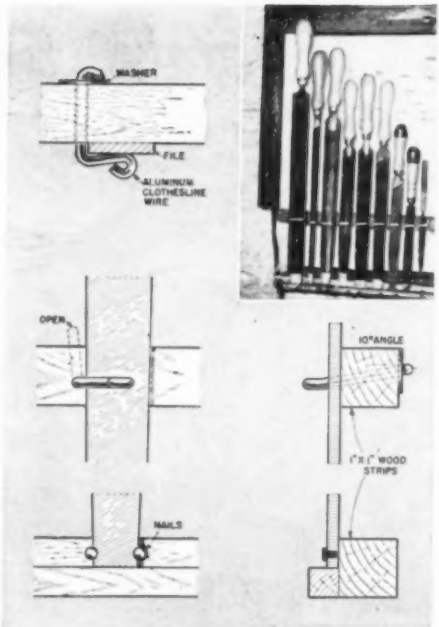

Wire Clips Hold Long Files

Short and medium files can be kept in slotted bench racks nicely, but long ones are awkward to lift from such holders. The rack in my shop has wire catches instead of slots. When these are turned, the files come right out from the front. The secret in making the clips work well is shown in the drawing. Drill the holes they turn in at a 10° upward tilt. Bend the clips to pinch the files tight when turned horizontally.—*Lowell Gfell, Coraopolis, Pa.*

Why Do Stars Twinkle?

It's the eye of the observer that makes stars twinkle, two British scientists suggest, rather than the refractive tricks of the atmosphere that have been held responsible up to now. Their new theory explains why naked electric light bulbs twinkle, too, when seen miles away on a dark night.

Individual receptors in the retina of the eye differ in sensitivity, they point out. A tiny star image covering only a few receptors therefore seems to fluctuate in brightness, or "twinkle," as slight eye movement shifts it upon the retina. When a telescope magnifies the image, it covers more receptors, their differences average out, and the star ceases to twinkle.

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You get a most durable serviceable, economical type of flooring *for the price of the tile alone* when you install MA-TI-CO yourself. The average 9′ x 12′ room costs as little as $15. If you had the floor installed by a professional, it would cost you up to $60. "Install-it-yourself" saves you more than 2/3rds.

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Please send complete install-it-yourself instruction kit, illustrated literature and color charts. Enclosed is 10c to cover mailing.

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TWO MODELS
No. 1950-H (with precision hand-operated chuck) ONLY $17.95
No. 1950-G (with precision gear chuck) ONLY $19.95

- Tops in Quality
- Right in Price
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Want power and speed, easy action, and durability in a drill that does just about everything? Then get the feel of this streamlined Zephyr! Weighs only 3 lbs. 2 oz. but it's husky for work; engineered for accuracy and long tool life. Fan-cooled 110-120 volt motor delivers 1000 rpm. with full load; 1600 rpm. with no load. Cutler-Hammer trigger switch. Housing, handle, gear case of die-cast aluminum. U. L. listed. Attachments (available at extra cost) make it a work saver on scores of jobs—sanding, polishing, buffing, grinding, sharpening.

Portable Electric Saw

ZEPHYR MODEL 625
$39.95 COMPLETE

The portable saw with all the features! Cuts to 2⅛". Adjusts 90° to 45°. Balanced for easy, one-hand operaton. AC-DC motor 115-120 volts.

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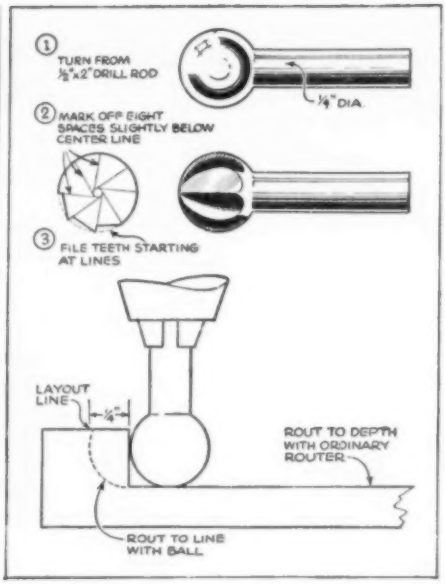


Drill-Rod Cutter Routs Trays

THIS homemade ball cutter will form a uniform cove edge on wooden trays and similar projects that have a hollowed-out pattern. It will do this part of the job at machine speed, leaving comparatively little hand work to be done.

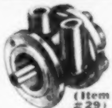
Make it by turning the ball shape and ¼" shank on ½" drill rod. Mark off the ball into eight equal parts. File teeth about 1/16" deep, beginning at each line and carefully filing over to the next line on the left. The job sounds harder than it actually is, for it requires only flat filing and a slight rocking motion. Shape the teeth with a rough file, and then go over them with a fine file to get a sharp, even edge.

To harden the ball, heat it until bright red and quench it in salt water. Polish the tip and temper it by heating it slowly and evenly until it just begins to turn blue. Quench it at once in oil. For maximum sharpness, touch up the teeth again with a medium India stick.

Bottom sketch shows procedure for laying out a tray-routing job. Level the bottom of the tray to full depth with an ordinary router, going within ¼" of the line. Switch to the ball cutter and finish routing to the layout line. Break the top corner slightly with sandpaper.—*Herbert Pfister, The Bronx, N.Y.*

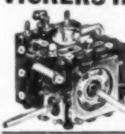
GROBAN'S BRAND NEW **WAR SURPLUS BARGAINS** ALL FULLY GUARANTEED

LOGAN HEAVY DUTY
HYDRAULIC PUMP



For operating hydraulic cylinders and hydraulic motors on tractors, buildozers, construction machinery, lift trucks, industrial applications, etc. Delivers 10 GPM at 1200 RPM at 1000 P.S.I. using 6 HP. Has 3/4" inlet, 1/2" outlet, 3/4" shaft with flat and keyway for direct or pulley drive. Has flange with 4 bolt holes for convenient mounting. Ship. wt. 22 lbs. Overall dimen.: 7" L x 5 1/2" H x 5 1/2" W. A $105.00 value FOR ONLY .... **F.O.B. Chicago** (Item #29) **22.50**

VICKERS HYDRAULIC TRANSMISSION



MODEL AA16801A Ideal for lathe drive, miniature cars, power machinery, gearing, etc. Rated 2 HP maximum input at 3750 R.P.M. Output speed continuously variable from 0 to 1/3 of input speed in either direction. Self contained reservoir. All controls external. Even power at all speeds. Complete with two 1/2" shafts with flat for pulley attachment. Shpg. wt. 20 lbs. Gov't. acquisition cost $325.00. A tremendous value at........ **(ITEM #85)** (F.O.B. Chgo.) **25.00**

HYDRAULIC CONTROL VALVES

ITEM #24. Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Ship. wt. 8 lbs. A $38 value. **postpaid** .... **7.95** (ITEM #24)

ITEM #26. Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Ship. wt. 6 lbs. A $60 value. **postpaid** **10.95**

Hydraulic Cylinders-Air or Oil

Large supply of new labor-saving, economical hydraulic equipment in many types and sizes. Use these positive, highly efficient, smooth pressure hydraulics on presses, arbors, lifts, loaders, power control, positioning, brakes, plastic dies, auto frame alignment, etc., etc.

(Item #42)

ITEM #4—All steel double action hydraulic cylinder, 1 1/8" bore, 2 7/8" stroke. Clevis mounting. Will lift 1000 lbs. with 1000 P.S.I. line pressure. Perfect for positioning and feeding movements. Shpg. wt. 4 lbs. **F.O.B. Chicago** **4.95**

ITEM #33C—Double action hydraulic cylinder, 1 1/2" bore, 4 1/2" stroke. Clevis mountings at both ends. Uses 1/4" pipe fittings........ **Postpaid** **8.95**

ITEM #32—Double action, 1 1/2" bore, 9" stroke, will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 4 lbs. A $45.00 value. **Postpaid** **10.95**

ITEM #41—Double action hydraulic cylinder, 2" bore, 6" stroke, clevis mounting at base and end of shaft. Overall length closed 12 1/2". Has 3/8" stainless steel shaft, uses 1/4" tubing fittings. Will lift up to 3100 lbs. with 1000 P.S.I. line pressure. Weight 7 lbs. **Postpaid** **12.50**

ITEM #16—Double acting cylinder, 1 1/2" bore, 2" stroke. (Will lift 1760 lbs. with 1000 P.S.I. line pressure. Wt. 8 lbs. A $55.00 hydraulic cylinder value for only **Postpaid** **12.95**

ITEM #15—Double acting cylinder, 3" bore, 10 1/2" stroke. All steel hydraulic cylinder, will lift up to 7000 lbs. with 1000 P.S.I. line pressure, Wt. 12 lbs. A $78.00 value, **Postpaid** **19.50**

Item #40—Double action, 3 1/2" bore, 20" stroke. Rated lift capacity 9600 lbs. with 1000 P.S.I. line pressure. Clevis mounting, aluminum alloy barrel with 1 1/2" stainless steel shaft and piston. Wt. 20 lbs. A $125.00 value. **F.O.B. Chicago** **25.00**

ITEM #42—Double action hydraulic cylinder, 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. line pressure is 12,500 lbs. Ship wt. 30 lbs. **F.O.B. Chicago.** An Excellent Buy for **32.50**

HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for 3/8" pipe and 50c ea. for 1/2" pipe.

UTILITY PUMP ROTARY VANE TYPE

Perfect For Water, Oil or Insecticides

Sprays DDT, 2-4D, sulphur compounds, etc. Pressures to 150 lbs., 15 gals. per min. at 1200 RPM using 2 HP. As vacuum pump for milking machines, lab use, etc., delivers 26" vacuum, 1.5 cu. ft. per min. at 1500 RPM, using 3/4 H.P. Rotate either direction, 1/2" pipe thread ports, 1/2" standard shaft, 4 ball bearings. Easy to mount—Ready to run. Shpg. wt. 13 lbs. F.O.B. Chicago (ITEM #51) **16.50**

G-I STAINLESS STEEL TANK

(ITEM #63)

Use these tanks on compressors, for tire inflators, pulsation chambers, floats, buoys, hydraulic reservoirs, fluid and milk containers, fuel containers, etc. Tough, light, shatterproof, 450 P.S.I. Aviator's Breathing Oxygen bottles, type G-1, 2500 cu. in. (approx. 9 gallons) int. vol. 24"x12", 1/2" threaded openings at ea. end. Wt. 19 lbs. **(ITEM #63)** Each **F.O.B. Chicago** **4.95**

***FREE:* 44-PAGE CATALOG**—**Full of unsurpassed War Surplus "buys" including generators, pumps, welders, double action hydraulic cylinders, control valves, tanks, pumps, hose, fittings, and data on hydraulic applications. Write today!**

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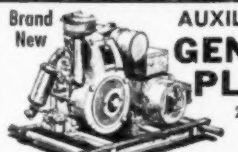

(ITEM #88)

AUXILIARY ELECTRIC AC
GENERATING PLANT
For General Utility and Emergency Use

2500 watts • 115 volts A.C. 60 cycles

Plenty of current to operate your: Oil Burner, Sump Pump, Refrigerator, Home Freezer, Power Saw, Lights, Radio and Television, Home Water System Pumps.

Complete integrated heavy duty electric power plant, Signal Corps Model PE-75, driven by Briggs & Stratton, one cylinder 6 1/2 H.P. Model ZZ, 4-cycle engine with killer button, oil bath air cleaner, governor, muffler, starting rope, and radio interference filter. The self-excited Leland or Westinghouse generator is rated 2500 Watts, 115 Volts, 60 cycle A.C. single phase, belt driven, with guard and duplex receptacle. When generator is not in use, you can use the engine separately to power other equipment. Mounted on adjustable steel skids, notched for carrying poles. Net wt. 310 lbs. Shpg. wt. 440 lbs. Dimen. 56" x 19 1/2" x 24". 12 month guarantee. $726.00 value. **NOW** .... **295.00** F.O.B. Chgo.

NEW! STATIONARY OR PORTABLE (ITEM #65)
D. C. ARC WELDER
250 AMPS. MODEL 252

FOR ANY WELDING JOB, LIGHT OR HEAVY

Stop Costly Repair Bills, Weld It Yourself and Save

Only one or two jobs will pay for entire welder.

Designed for many years of trouble-free service. This precision engineered Direct Current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly where and when you need it. Has dial type rheostat for easy pinpoint control and a high-low range switch. Run welder at 2500 RPM from drive pulley or power take-off of tractor, a 7 1/2 HP electric motor or a 10 HP gas engine. Use two V belts or flat belt (on pulley).

Now . . . AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Shpg. wt. 107 lbs. **F.O.B. Chicago** **99.50**

ACCESSORY KIT including welding helmet, electrode holder, two 10 ft. cables with clamp and 5 lbs. of assorted welding rods. **(ITEM #66)** ....Shpg. wt. 17 lbs. **F.O.B. Chicago** **10.50**

If more information is desired write for welder circular.

Brand New

(Item #97)

SURPLUS SPECIAL!
CONTINENTAL RED SEAL 1 1/2 H.P. ENGINE

1 cylinder, 4 cycle gas engine with 6:1 gear reducer for 300 to 400 RPM output.
• For Lawn Mowers, Garden Tractors, Light Farm machinery, Feed Mills. • To drive Pumps, Compressors, Generators.
Engine rated 1800 to 2400 RPM. Complete with starter rope, muffler, oil bath air cleaner. Shpg. wt. 60 lbs. A $74.00 VALUE. NOW . . . WHILE THEY LAST . . . (F.O.B. Chicago) **39.50**

EMERGENCY ELECTRICITY!
750 WATT • 115 VOLT • 60 CYCLE
A.C. LIGHT PLANT

(Item #86)

USE FOR: Home lighting, trailers, tourist cabins, hunting lodges, fire truck lighting, emergency standby units. Plenty of power for deep freezer, oil burners, incubator, radio or lights.

GENERATOR: Manufactured by Elcor, rated 750 Watts 115 Volts A.C., 60 cycles at 1800 R.P.M. Complete with volt meter regulator. $249.00 value. These generators, built to exacting Signal Corps specifications, are the answer to your lighting needs.

GASOLINE ENGINE: Briggs & Stratton, Model BP, 3 HP., 1800 R.P.M. Completely radio shielded, full accessories including air cleaner, muffler, starting rope, killer button, remote control wire. Shpg. wt. 165 lbs. **Complete unit. $249.00** Value. (F.O.B. Chicago) **NOW ONLY** **139.00**

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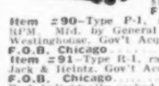

For welders, plating, truck and marine use, D.C. appliances, lights, etc. Aircraft quality—lifetime grease sealed ball bearings. Heavy duty.

Item #89—Type M-2, rated 50 Amps.—24 Volts Mfd. by Leece-Neville Co. Shpg. wt. 32 lbs. Gov't. Acq. Cost $176.00. **F.O.B. Chicago** **NOW ONLY** **16.50**

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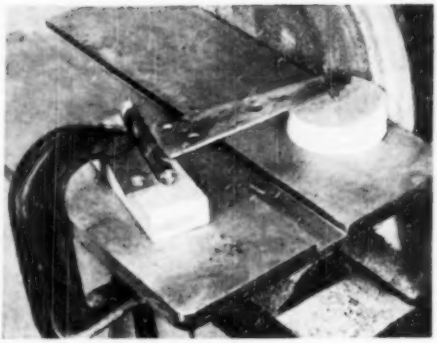
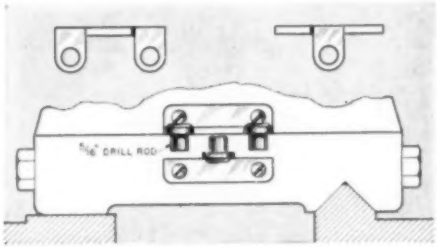


Sanding Jig Rounds Disks

You can make truly round wheels or drums on your disk sander with this simple jig. Sharpen the tip of a 3/16" by ¾" machine screw and lock it in the end hole of a T-hinge. Block the base of the hinge up to the desired height and clamp it in place. Rough out a blank disk, hold it down under the pointed screw with one hand, and turn it against the sanding wheel with the other. *—E. S. Bryant, Rochester, N.Y.*



Tailstock Setting Miked

You can use your micrometer or vernier calipers to adjust the lathe tailstock accurately for taper turning, and to realign it exactly afterward. All it takes is a pair of brackets mounted permanently on the two parts of the tailstock as shown.

The brackets can be made of angle stock and the pins of drill rod. Shoulder these down and either thread them or rivet them over in the bracket holes.

Check tailstock alignment, if necessary, by turning a test bar between centers. Then take a mike reading over each end pin and the center pin. Record the readings for future use as "zero right" and "zero left." For taper turning, add or subtract the required offset, using whichever reading is convenient.*—Jesse R. Lucas, Michigan City, Ind.*

DREMEL'S STRAIGHT-LINE ACTION

GUARANTEES SCRATCH-FREE SURFACES

Here's fast cutting, finish sanding at its best. Dremel introduces a new electric sander, sturdily built to withstand hours of continuous use. It is light in weight . . . will not tire operator. Its **straight-line (non-rotary) action** leaves no scratches, no rotary marks—just satin-smooth surfaces ready for any type finish. Here, for the first time, is an electric sander built for years of faithful service—all at the remarkably low price of **only $24.50.**

A POWERFUL, FAST CUTTING TOOL FOR CRAFTSMEN, HOME and INDUSTRIAL USERS

Craftsmen find this new Dremel model has the extra stroke and power needed for heavier woodworking projects such as cabinet-making, boat building and refinishing, garden furniture, etc. Home-owners say it's just the tool for preparing surfaces for painting and varnishing—for refinishing walls, woodwork, furniture, dry wall joints, siding and other surfaces. The Model 2000 also does a professional job of polishing waxed surfaces—eliminating all the back-breaking labor on cars, furniture, floors, stairways, etc. Industrial users likewise find this new Dremel Sander a faithful performer in furniture, cabinet, building and body shop operations.

RUGGED DESIGN and PERFORMANCE FEATURES

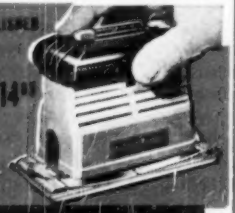
- Only two moving parts—requires no oiling.
- Reciprocal (straight-line, non-rotary) action leaves no marks . . . cannot burn surface.
- 21 square in. sanding surface speeds production . . . 14,000 cutting strokes per min.
- Cam-type holder permits changing paper in seconds.
- Die-cast aluminum housing with moulded Bakelite cover . . . Light weight, only 5 pounds. Over-all size 3½" wide, 4½" high, 7" long.
- 8 ft. Underwriters Approved cord . . . uses 110-120 v. A.C.

PRICE INCLUDES STURDY CARRYING CASE

Perfect portability of Sander, cord, abrasives, and polishing pads is provided in this sturdy, 3-shelf metal storage case. Price also includes 25 assorted sheets abrasive paper and a high grade sheepskin polishing pad.

DREMEL Model "A" SANDER-POLISHER OVER 200,000 NOW IN USE!

A lighter-capacity Sander that takes all the work out of home or hobby projects. Popular with women for polishing furniture, etc. Same design and construction features as larger model. Furnished in attractive cardboard box. If your dealer can't supply, order direct from factory. $14.95



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Don't confuse Moto-Tools and Accessories with so-called "bargain offers." Compare Dremel feature for feature with competitive tools. If our products are not superior in every way, we don't want you to buy.

MOTO-TOOL KIT NO. 2 With 25 Accessories (High Speed Steel Cutters, Grinding Wheels) **$23.50.**
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Only $9.95

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DREMEL Electric COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

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For home, hobby, repair work—no other tool pleases so much for so little cost. Works in any direction—delivers 7,200 strokes per minute effortlessly. Saws through ¼" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only 2 moving parts, with cam saw never needs oiling. Uses 110-120 v. A.C.

. . . for 4 useful projects packed with each saw

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How to get smoothest jobs ever with wonderful new NYLON paint brushes!

Dip only half the length of the bristles in paint—on overhead work dip to only one inch. Tap off the excess paint. Don't scrape off on edge of can.

Nylon brushes hold a full load of paint. And they are ideal for nearly all finishes.

To get the best results, use a long, steady, even stroke, painting toward the surface already coated.

Durable nylon bristles don't break off and mar your work, and an independent research laboratory has found that nylon brushes paint smoother.

Use correct brush for each job. Poking large brushes into corners causes "fingering."

You can get a set of nylon brushes for every job, from touch-up work to wall and roof painting. They're made by leading manufacturers.

Clean thoroughly, suspend brush on wire in turpentine or linseed oil for storage between jobs. Resting bristles on bottom of can deforms them.

Nylon brushes clean quickly and easily. Work out paint on newspaper, clean with thinner, rinse with soap and water. Then comb the bristles and wrap the brush for storage.

The next time you paint, try a smooth-painting, easy-to-clean nylon paint brush. You will never use any other kind. They're sold in paint, hardware and variety stores everywhere in all types and sizes.

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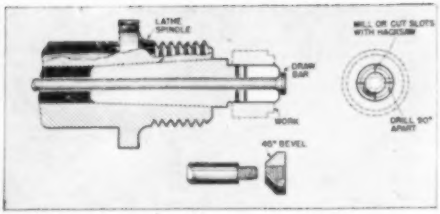
Better Things for Better Living
... through Chemistry

NYLON
PAINT BRUSHES
for smooth painting...easy cleanup

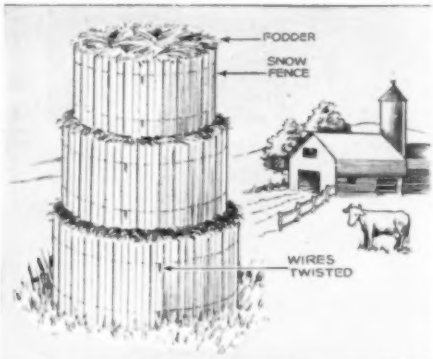


Drawbar Tightens Mandrel

A STUB mandrel you can use again and again is handy for bushings and other jobs requiring an outside diameter concentric with the bore. Made of cold-rolled steel, this one can be turned down easily to any smaller or special size needed.

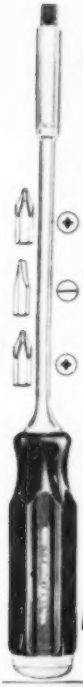
After forming the taper, seat it in the spindle and drill the drawbar hole through. Turn a shoulder about a thousandth smaller than the bore of the work to be held, and turn the 45° drawbar seat in the end. Remove the piece from the lathe to drill two transverse holes at 90° to each other close to the shoulder. Mill or saw slots 90° apart from the end to the holes.

The drawbar runs through the spindle. Thread the outer end for a nut, handwheel, or collar.—*Jesse R. Lucas, Michigan City, Ind.*



Fence Makes Stand-by Silo

WHEN the main silo is full, sections of snow fence will serve as a temporary storage space for fodder. Form a circle with a length of the fence and wire the ends together. When this one is full, add additional circles of fencing. Make each succeeding circle smaller in diameter than the preceding one. A length of common woven wire fence around the silo will add to its strength. —*Victor H. Lamoy, Upper Jay, N. Y.*



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● Starts and completely drives screws in awkward or hard-to-reach places... with *one-hand* operation. Permanent Alnico magnet in shank charges bit with a "pull" TEN TIMES more powerful than ordinary "magnetic" screw drivers.

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Magna Tool Corporation
Buffalo 3, N. Y.

LOCKS onto the work "HOLDS ON," after you let go.

Finest locking plier because...

Clamps on better with *patented swivel jaw* which adapts itself to shape being held. **Faster working** because of *patented jaw size indicator;* you pre-set jaw size to approximate size of object. **Easier opening** with *patented lock release;* finger-operated lever readily releases 2000 pound bite.

$1.75 7" size
10" — $2.25
Both bright nickel finish

At your dealer's. Send for FREE folder.

SEYMOUR SMITH "Snap-Lock" PLIER-WRENCH

SEYMOUR SMITH & SON, INC.
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100 years of quality tools

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MODERN INSULATION MAGIC
YOU'LL BE AMAZED WITH
REYNOLDS ALUMINUM REFLECTIVE INSULATION

500 sq. ft. under his arms — Easy to tack or staple

Work a "miracle" in your walls or attic with this aluminum foil bonded to tough kraft paper. Costs $30 to $40 for average attic. Reflects up to 95% radiant heat. Summer heat bounces off, interiors often 15° cooler. Winter heat reflects back inside. Clean, odorless, pliable. Tack or staple over ceilings or under rafters, between wall studs, under ground floors. Perfect vapor barrier. Fire-retardant. Two types: foil on both sides for double air space, one side, to face single air space. Rolls 250 sq. ft., 25", 33", 36" wide. Also makes wonderful reflectors for radiators, photo lights, etc. Mail coupon for *free samples.*

Aluminum Sheet for Rustproof Flashing, Termite Shielding, General Shop Work!

Reynolds Lifetime Aluminum in 50-ft. coils, 14", 20" and 28" wide, .019" thick; and flat sheet .019" and .024" thick, 28" x 6', 8', 10' and 12'. (20" coils also in embossed finish and .024" thickness.)

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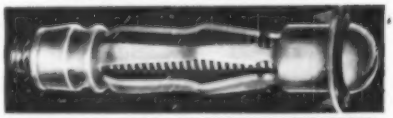
SCREW ANCHORS



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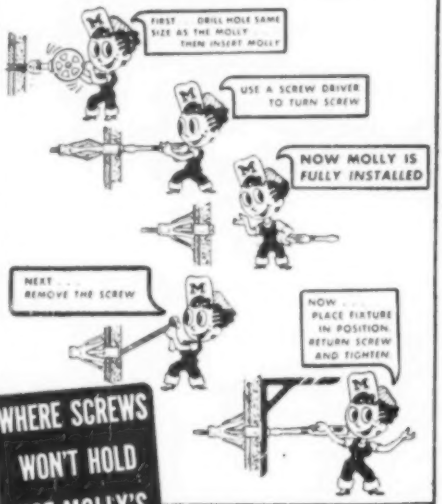

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MOLLY FASTENS SECURELY

Sinks • Soap Dishes • Fuse Boxes • Wall Clocks • Mirrors
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Bathroom Cabinets • Tool Racks • Venetian Blind Fixtures
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MOLLY'S are inexpensive, easy to install in walls, floors, or ceilings and assure a safe, secure mounting that will never become loose. *ASK YOUR HARDWARE DEALER.*

MAIL THIS COUPON FOR *FREE* DESCRIPTIVE FOLDER

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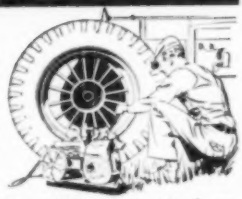
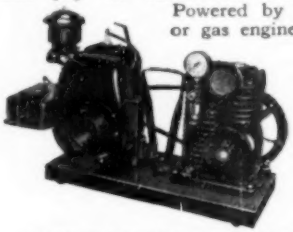
Makes every job EASIER



YOU have never seen a single cylinder portable air compressor that packs so much power as this one. Built by the makers of the famous 4 cylinder Pressure Queen, the Princess will do any job, from inflating tires to painting buildings. Compact, simple and rugged, it will last your lifetime and pay for itself over and over again. Powered by electric motor or gas engine.



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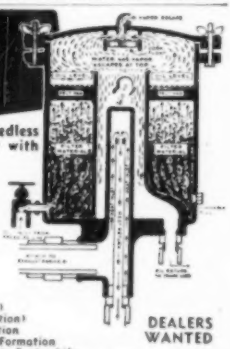

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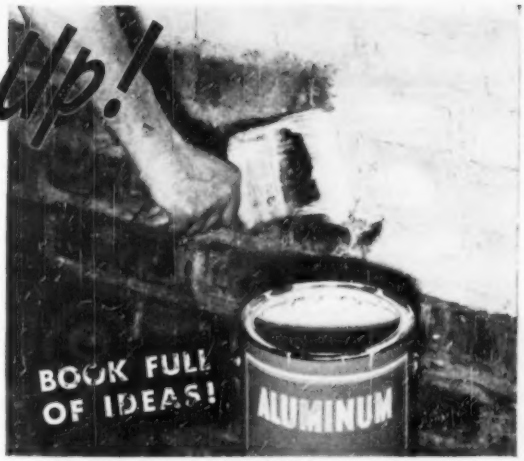

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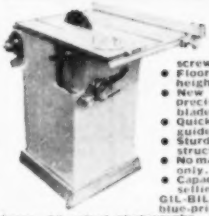

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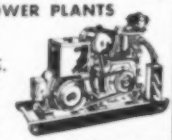

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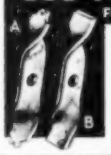

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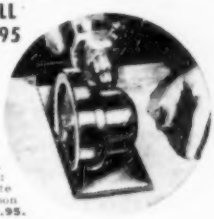

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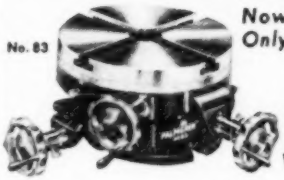

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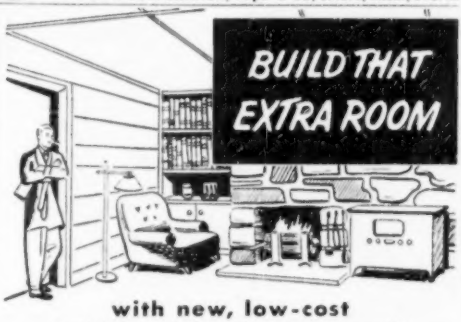

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The Home-Utility 5" Sander-Polisher is a versatile appliance that's perfect for your home! You'll use it for polishing and waxing cars, floors, furniture, woodwork; sanding to remove paint and varnish or to prepare surfaces for finishing; drilling for cabinet work or repairs. With additional low-cost accessories, it will also grind, sharpen, clean, buff, burnish! Extra-powerful motor for high-speed work operates on any light circuit, drives wood augers to ½" diam. in hardwood as well as twist drills to ¼" diam. in steel. See it, try it at your hardware, electrical or implement dealer's! THE BLACK & DECKER MFG. CO., Dept. H98, Towson 4, Maryland.

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World's largest builders of quality electric tools!

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LECTRO-SAWS • BENCH GRINDERS

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INTRODUCTORY KIT by Mail
Contains 2 big 6" Dico Buffing Wheels, 2 tubes of Dico Composition and Buffing Manual. MAILED POSTPAID if dealer can't supply. Give **spindle diameter** of your power unit.

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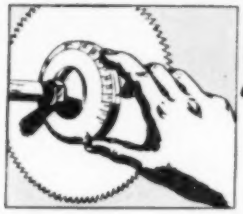
Better, Easier, Quicker GROOVE CUTTING or CABINET-MAKING

with Warren DADO SAWING WASHERS



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Cut accurate, parallel grooves—any width, any angle. Just dial desired width with Micromatic adjustment. Cuts smooth and clean—no burning or chewing to mar fine wood. Just four simple washers. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". Free booklet on request. See your dealer or write direct. Absolutely guaranteed! In Canada, send money order for $4.95 (duty and sales tax extra).

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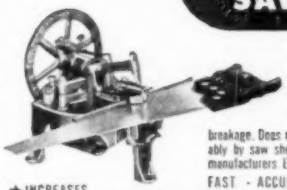
BeMaCo Dependable

AUTOMATIC SAW SET



Sets 400 teeth per minute on hand or band saws 4 to 16 point. Hammer and anvil action sets teeth accurately and uniformly . . . No tooth breakage. Does a perfect job. Used profitably by saw shops everywhere and saw manufacturers. Every machine guaranteed!

FAST - ACCURATE - DEPENDABLE

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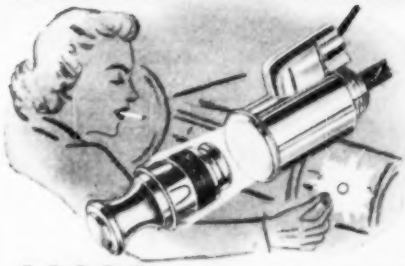

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Illuminated Automatic

CIGARETTE LIGHTER

Why be without the convenience of this great new Vis-O-Lite illuminated lighter that makes driving safer day and night? You can replace your old lighter with a new Vis-O-Lite in a matter of minutes with pliers and screwdriver . . . and get the advantages of an illuminated lighter—well that ends fumbling in the dark, prevents scratching dashboards. Made by the manufacturers of the original pop-out lighter that's standard equipment on 4 out of 5 cars. Costs only **$2.75** complete. The illuminated well-assembly alone (minus the pop-out unit) costs only **$1.25.** Now on sale at Car Dealers, Auto Supply Stores and Service Stations.

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SURPLUS MACHINE SHOP TOOLS

LARGE VOLUME PUMP

Capacity 400 GPH @ 1750 RPM. 1/2" drive spline. Maximum head pressure 30 PSI. 3/4" pipe inlet and outlet. Rotate either direction. Built-in relief valve. Ideal for all types of sprayers, etc. Reconditioned guaranteed. Priced at only **$4.98**

Discounts on quantity.

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With built-in adjustable relief valve. This brand new, powerful, gear-type pump is rated at 1000 PSI, 8 G.P.M. at 3750 R.P.M. Delivers up to 6 H.P. Requires 1½ to 6 H.P. to drive directly. 1½" drive spline and ¾" pipe ports. Weight approximately 7 lbs. Prices at only **$8.96**

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High pressure Adel valve for controlling cylinders and other hydraulic equipment. ¾" pipe ports. Heavy steel construction. Priced at only **$5.98**

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3/16 x 3/16 x 2½" 8 Pieces	**$1.79**	3/8 x 3/8 x 4" 4 Pieces	**$1.95**
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$1.95 1 Piece

Additional discounts on larger quantities.

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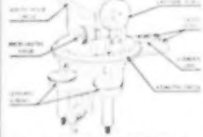

Brand New Mark II Airforce navigation instrument. Excellent for schools, math classes, etc. Can be adapted for transit or level. Precision built throughout. Government cost over $125.00. Comes complete with mounting base in wood carrying case and web strap. Weighs only 6 lbs. Full operating instructions supplied. Priced at only **$9.95**

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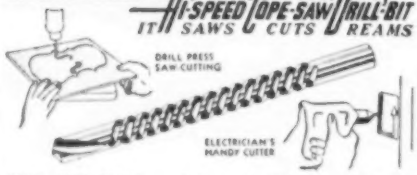
T & T TOOL — **101 WEST ARCHER TULSA, OKLAHOMA**

MILLER ROTARY

IT SAWS HI-SPEED CUTS ROPE-SAW REAMS DRILL-BIT



SAWS, CUTS, REAMS — Sheet metal, angle iron, pipe, wood, plastic. Transite, etc. Amazing high-speed combination bit and saw fits any ¼" or ½" electric drill or slow drill press. Drills own starting hole to quickly cut, saw or ream opening. Easy to operate. Ideal for carpenters, auto mechanics, electricians, plumbers, hobby workers, many others. Abrasive resistant high speed steel. No breaking. Will withstand severe continuous use. Resharpened at no charge. ½" diameter, over-all length 3½", cutting section 2" long with flutes ground from solid. Shipped same day — money back guarantee.

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9.95 compl. with 4" "HYCARBON" Blade

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Any ¼" or ⅜" Drill a Powerful Saw in ONE MINUTE

"ARCO-SAW" is a rugged tool with **right angle gear drive** (no clumsy, dangerous, direct drive with drill sideways). Works like a high priced Portable Saw.

Cuts 1-5/16", or 2 x 4 by turning over

Only ARCO Gives You All these Features: Safety-yoke assures rigid connection and **absolute safety—Big handle** affords firm grip for two-hand operation. **Precision one-piece** gear box. **Self-lubricating** lifetime bearings. **Wide shoe-plate** for straight, square cuts. Lowest priced quality Replacement Blades.

"HYCARBON" Crosscut Blade $1.60
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90-day Factory Guarantee

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NOW! EVERY "ARCO-SAW" AN ANGLE SANDER & POLISHER

Your "ARCO-SAW" becomes a powerful **right angle** sander & polisher in just a few minutes. Ideal for removing paint from cars & walls, smoothing cars, polishing linoleum & furniture. **Swivel action** between drill chuck & gear box permits new freedom of use at any angle on every surface, or when necessary safety-yoke can be used to hold unit rigid. No need to buy an expensive special angle gear drive. New ARCO "SAND-'N-POLISH" Attachment consists of flexible molded rubber head, sanding disc, lambswool polisher, bottom plate, hexagon adaptor, & also ½" adaptor for use in drill chuck.

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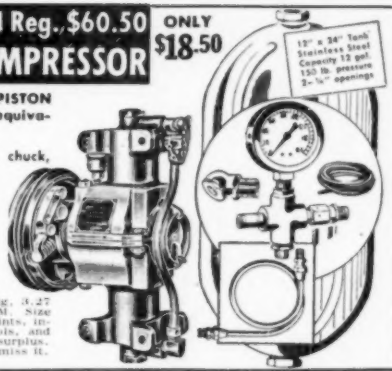
Model T-1 Brand New — 2 CYLINDER PISTON TYPE. Operates with ½ H.P. Motor or equivalent gas engine.

Compressor, pressure tank, air gauge, air chuck, 20-ft. hose, pop valve, copper tubing with 4 brass flared fittings for connecting compressor to tank, 4-way cross and 3 nipples.

COMPLETE OUTFIT, wt. 52 lbs..... **$29.45**

EQUIPMENT LESS COMPRESSOR, $10.95
COMPRESSOR SEPARATELY $18.50

Compressor has 2" bore, 1½" stroke, ball bearing, 3.27 CFM at 600 R.P.M. Capacity up to 6.54 CFM. Size 9"x11⅞"x6⅝", Wt. 26 lbs. Ideal for spraying paints, insecticides, etc., Inflating tires, operating air tools, and other uses. All new equipment. U.S. government surplus. Replacement parts available. Amazing buy. Don't miss it.



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Takes starting load off engines or motors. When speed is reached, a flip of handle shifts clutch from idling to driving position. Handles "A" belts, 2.35" pitch diameter, ⅝" bore. Ideal for use with lawn mowers, garden tractors, home workshop motors, etc. 31½" long. Safe, easy to mount, sealed bronze bearings, positive action. Shpg. wt. 3 lbs.

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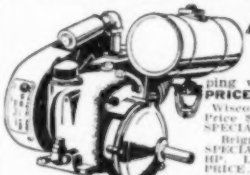
Same clutch furnished with ¾" bore. **$8.50**

SAVE 50% ON GAS ENGINES

Red Seal Continental



Gas engine. 1½ HP with 6 to 1 reduction gear. Operates at 450 R. P. M. List Price $79.50. Shipping weight 54 lbs. SPECIAL PRICE..... **$39.50**

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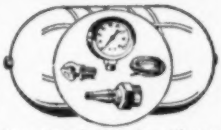

Air receiver, stainless steel, 12"x24", 400 lb. test. Ideal for carrying on trucks, autos and wherever compressed air is needed. Equipped with 500 lb. air gauge, tire chuck, 3 ft. high-test air hose, air inflation valve with core for retaining pressure in tank, and fittings. Two ¼" openings.

Complete outfit with 12"x24" tank, ship. wt. 20 lbs..... **$6.95** Tank only $4.95

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Water repellent, wind resistant, Nile Green combed Gov't. Zeelon sanforized Poplin. Full sturdy zippered front with 100% wool pile lined sleeves & body. Two slash pockets & large Mouton Fur Collar. Ribbed cuffs and bottom.
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Has semi-telephoto 1 3.8" (35mm) lens with yellow filter — 3 shutter speeds: for normal (16 frames) semi-slow motion (32 frames) and slow motion (64 frames per second). Uses any standard Eastman film magazine or Type "G" AAF magazine. Takes Black & White or Full Color pictures. Operates on 24V (dry cell batteries) & requires slight conversion for hand use. Diagram furnished. Cost Gov't $235.00. NOW $24.50
CONVERTED GUN CAMERA — Fully reconditioned with start switch on front. Choice of finishes — Grey, Black, Blue. $33.95

U.S. AIR CORP RUBBER BOATS

The Fisherman's Delight
Reconditioned and ready . . . with carrying case. Safe, Lightweight, Easy to Pack and Carry. An Ideal boat for fishing or fun.
1 MAN with PADDLES 14.95 — 4 & 5 MAN 29.95
Oars 2.95 pr. Pump 2.98 ea. — 7 MAN 42.50
Also available: filling adaptors for air refills at any gas station. 1.29 ea.

"MAE WEST" Pneumatic LIFE JACKET

Another necessary item for your summer or fall vacation. These AAF rubber boats have been fully reconditioned and are ready for immediate use. Comes complete with carrying case. Safe and lightweight. For Fishing or Fun. 2.49

GENUINE GOGGLES

Aviators (AN 6530) Windproof & Dustproof
Rubber or chamois covered frame. Clear or Green GROUND LENSES are inter-changeable. Adjustable nose bar. Ideal for flying, motor cycling, etc. 1.89

GO-1 GOGGLE KIT
NEW! U.S. Navy — Has soft sponge rubber frame. 4 Polaroid lenses 2 green, 1 red, 1 clear. Perfect for racing, cycling, etc. 89¢

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ARMY AIR FORCE - 6 base. Precision Polished & Ground Glare-Free caliber lenses. Leather case to be attached to belt. Gold plated adjustable frame. Pearloid sweat bar and pads. $17.50 Palley value for ONLY 3.95

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EISENHOWER JACKETS — Famous for Smart and Rugged wear. Reissues in excellent condition 5.95
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BOLO KNIFE — 10" Parkerized blade, with case. 1.19

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25 lb. Test — 100 ft. Green . . . 1.59
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Match Box . . . . . 39¢
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Has Shock Absorbing Jewel movement. Sweep Second Hand, Luminous Dial, Polished Case. Guaranteed for 1 year. 6.95

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Low Impedence. Ideal for amateur radio, crystal sets, or professional use. Adjustable ear phones. Used and in excellent condition. 1.59
MS-30U — Two Magnetic Type receivers in water-tight brass case. Soft rubber inserts in each receiver to fit into wearers' ear. Pliable steel head band. Ideal for communications, divers, workers in noisy compartments, etc. NEW 1.59

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Telephone type — Highly Sensitive with excellent, clear tone. This was the Signal Corps favorite. An ideal instrument for the radio "ham" and professional recording studio, broadcasting, home recording, public address, etc. A Sensational Buy! Complete with cord and plug. . . . ONLY 2.29

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With adjustable ball and socket swivel head, long rubber covered cord and wall plug.
The All Purpose Lamp. Wonderful for Indoor Photography. Floodlights. Baby Spot or Large Spot, Personal Bed Reading. Workbench. Garage. etc. Lamp Alone 99c
Highly Polished 9" diameter Parabolic Reflector or 5" diameter Spot Reflector at Only 85c ea.

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DIVING MASK
Soft rubber mask fits over eyes. Has heavy duty glass eyepiece. Adj. head-band. Sm. 1.59 Med. 5" 1.99 Lg. 5½" 2.95

SWIM FLIPPERS
Top quality rubber. Has pebble tread bottom. Adj. heel strap. Reinforced for strength. Vented for air & drainage. Ideal for diving and swimming . . . 5.95 pair

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Corrosion resistant. Ideal for spear fishing. 11" long with barbed ends. Dia. of socket 1" 39¢

DIVER'S UNIT Complete with air supply tank, regulator & base. For dives to 25 ft. depth. Holds air supply for approx. 15 min. per dive. 6.95
G-1 AIR STORAGE TANK—A days supply for diving unit. 12½" x 24". 500 lbs. pressure . . 4.75 . . . .
AIR HOSE— Used to top G-1 storage tank. To refill DV-1 Diving Unit 1.59

AIR CORPS HELMET
Fine grade leather — Chamois lined with chin cup on strap. Intermediate weight — Ideal for summer wear. NEW ONLY . . . 1.59

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Sturdy, Yet Light Wt. Satin Lined with Tie Straps. 14 Outside Pockets, Plus Knife, gun, or Tool, Leather Holder, 2 large 11" x 8" Pockets inside. Wonderful Hunting, Fishing, or Mechanic. A Steal 2.49

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Molded & pre-shaped. Can be cut to fit your Chair seat, Boat, Auto, Truck or Trailer Seats. Ideal for all Sports Events.
25" x 65" x 1½" $7.45
25" x 60" x 1½" $6.45
18¼" x 20¼" x 4½" $5.65
4½" x 18" x 22" $5.65
4' tpzd. to 2½" x 22" x 23" . $4.95
4½" x 15" x 16" $4.95

LEATHERETTE

to cover Chairs, Patio Furniture Nooks, Auto Seats, etc. 10 colors at a BARGAIN PRICE.

WIDTH	COLORS (perrunyd.)	PRICE
36"	Grey, Brown, Black	1.19
36"	Lt. Green, Dark Green, Blue	1.65
54"	Red, Grey, Lt. Blue, Ivory, Yellow	1.89

Name Brand PLASTIC LEATHERETTE
Waterproof, Heat Resistant plastic covering. In Yellow — Chinese Red, Green, Grey, Chartreuse, Brown, Yacht Blue. 54" Width. ONLY 1.95 yd.

TANK

Durat with welded seams, 2" filler with cap, two standard pipe parts for hookup. Visible liquid level gauge on side. Ideal for Gas, Oil, Water, or "spare" on auto, tractor, truck or boat. Sturdy, light. Capacity 6 gal. 4.95

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For Gas, Oil, Water, etc. Seamless, welded tank made of aluminum with filter Screen and Pack. Has stick level gauge. 19 gal. capacity 6.95

Order from this Ad. All sales final. All Prices F. O. B. Glendale. Pay by M.O. or Check. P.O.'s Accpd. from D. & B. firms. ½ deposit with C.O.D's.

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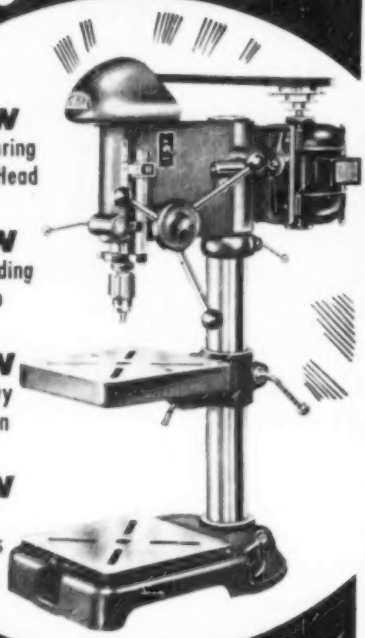

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★ NEW
Direct Reading Depth Stop

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Extra Heavy Construction

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Operating Smoothness

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For Your Shop

Add those new advancements to the known quality features of Atlas drill presses and you'll quickly see why you get *more value today in an Atlas.* With low-cost attachments it drills, taps, routs, sands, carves, mortises, shapes . . . gives you clean, precision workmanship on metals, woods, and plastics . . . makes your workshop hours more productive than ever. Write for full details.

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Atlas POWER KING

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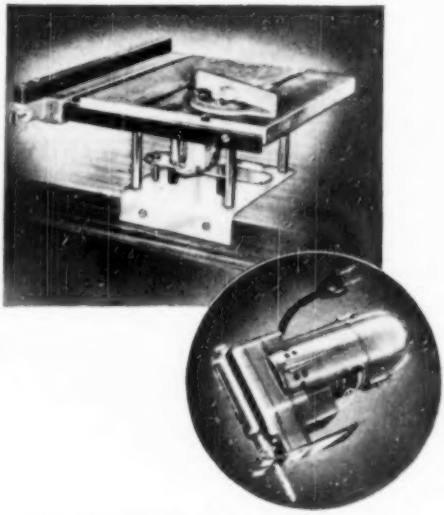
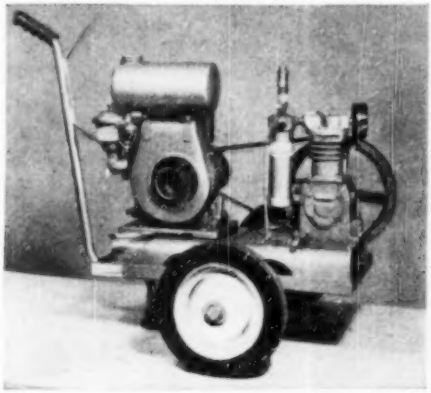
New



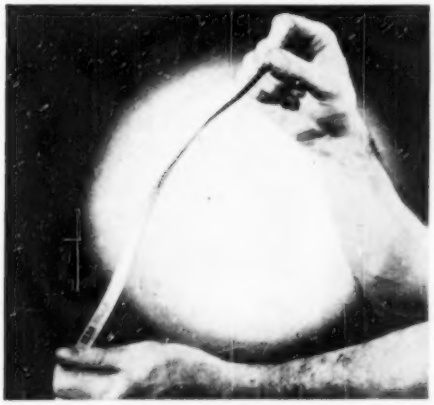
Stand for Portable Saw. By using this stand, the portable Whiz-Saw—made by the Forsberg Mfg. Co., Bridgeport, Conn.—becomes a fixed table saw. A spring clamp that can be quickly released holds the saw to the table. Price is about $19.

Micrometer Has Round Anvil. You can measure the wall thicknesses of tubing and cylinders with walls up to 1" thick and inside diameters down to ⅜" with this micrometer. The rounded anvil fits the inside curve of the wall to give accurate measurements in thousandths of an inch. The manufacturer is the L. S. Starrett Company, of Athol, Mass.

Tools



New Compressor. Powered either by a gasoline engine (above) or an electric motor, this compressor offers two working pressures and two air deliveries by shifting a lever. American Brake Shoe Company's Kellogg Division, New York City, is the maker. Pressures are 150 lb. for tire inflation or greasing and 50 lb. for spraying.



New Flexible Hacksaw Blade. According to the manufacturer, Clemson Brothers, Inc., of Middletown, N.Y., the Star Molyflex hacksaw blade is unbreakable when used in a frame. The blades are available in all hand sizes and pitches.

POWER KING #3001

The Lowest-Priced Ball-Bearing Tilt/Arbor Saw

Yes, now you can get real "production" on your shop projects — at low cost! — zip through your saw work in a tenth the time . . . make important savings on shelves, cupboards, cabinets, furniture, home repairs, and remodeling!

The Power King #3001 — built by Atlas — has many features of high-priced saws: tilt/arbor (table *always* flat), cuts 2¼" deep, sealed ball bearings, precision-ground grey-iron table (16" x 25½" with two low-cost extensions), full length double-locking rip fence. You can't beat its value—see it today!

PK 4½" Jointer-Planer
For "Factory-Smooth" Finishes

Your projects can have the smartness of professional furniture with this Power King 4½" Ball Bearing Jointer-Planer in your shop. Saves you time and work in planing, rabbeting, tongueing, beveling. It's built extra heavy, with grey-iron base and table — precision-ground table surface—tilting fence—3-blade steel cutter head — plus other outstanding features. A good companion tool for your circular saw.

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3 professional-type tools, plus permanent magnetic holder—$5.85

Your dealer has them or can get them for you.

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You know Utica is famous for quality among the trades and in all industry.
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Induction Hardened Wrench Jaws—On Utica's adjustable wrenches these vital edges are hardened by a patented process so they last 10 times as long.

UTICA DROP FORGE & TOOL CORPORATION
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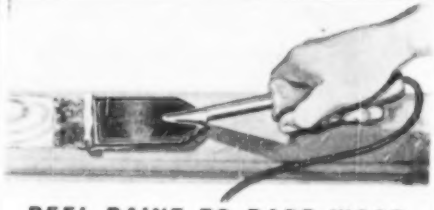
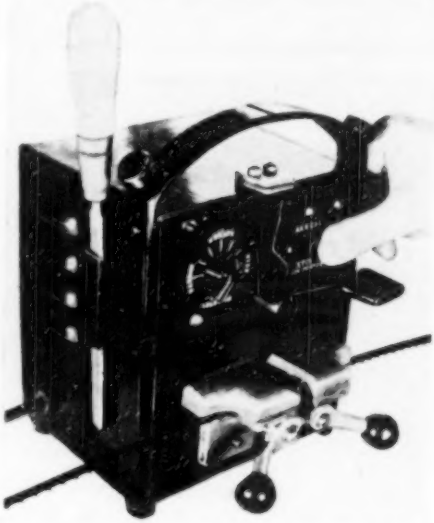


PEEL PAINT TO BARE WOOD WITH ONE EASY STROKE

NEW ELECTRICAL TOOL removes 1 to 10 or more coats of paint from any wood surface as easy as cutting butter with a hot knife. No scraping, cutting, burning, sanding, or chemicals. The new Lectro Paint Peeler instantly softens paint electrically and peels it off the surface clean to the bare wood with one easy stroke. It's faster than a blow torch—there's no danger of fire—will not scorch or burn delicate wood surfaces. Makes no mess—no smell—it's even fun to use. Removes any paint, enamel quickly and easily. Sturdily constructed to last for years. Sent complete with extra long, quality electrical cord. Simply plug into any A.C. or D.C. outlet—let heat for several minutes and remove paint to the bare wood on exterior or interior painted surfaces, floors, woodwork, cupboards, furniture, antiques, boats, window-sills, screens, doors—a hundred other uses. Price $4.95 postpaid—nothing else to buy. Full money back guarantee. For immediate shipment—send check, cash or money order to

LECTRO WELD, INC.
5700 Detroit Ave. Dept. PS-9 Cleveland 2, Ohio

New Tools



Butt Welder Is Portable. Bandsaw blades up to ½" in width can be welded and annealed in this machine. Besides repairing broken blades, the welder permits internal sawing jobs; the blade can be welded at the machine after being threaded through the work. It weighs 25 lb., measures 7" by 8" by 10¾", and operates on any 110- or 220-volt, 50- or 60-cycle line. The maker is the DoAll Co., Des Plaines, Ill.

Cushion for Hand Tools. This rubber sleeve, designed with a revolving rubber cap, cushions the palm of your hand when you use hand tools. The swivel top turns on two brass washers. The maker, Indian Trails Industries, Oshkosh, Wis., prices it at about 50 cents. The grip fits tools with handles from 1" to 1¼" in diameter. Undersized handles can be built up with tape.

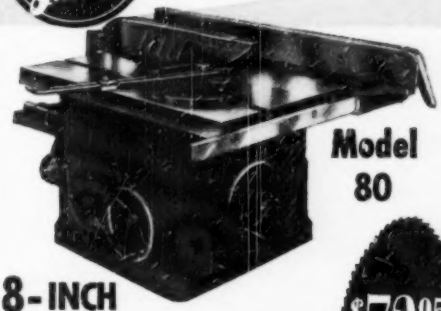
New Tools

Adapter Base for Grinders. This base, developed by E. F. Hager and Son, Queens Village, N. Y., converts almost any bench grinder into an accurate grinder for single-point cutting tools. All front, side, and top angles can be set accurately in both vertical and horizontal planes and locked in position for grinding. The tool holder takes tools up to 1¼" high. The feed knobs are graduated in thousandths of an inch.

Fins Keep Sander Cool. The heat-radiating system of this sander increases the life of the belts, according to the maker, Independent Pneumatic Tool Co., of Aurora, Ill. The radiating system includes open-end construction that lets the belt motion blow away much of the heat. Inside the housing, aluminum fins conduct heat to the flat radiating surface that forms the top housing of the tool.

Darra James POWER TOOLS

The Professional



Model 80

8-INCH TILTING ARBOR SAW at a HOME WORKSHOP PRICE

$72.95 less guard

Darra-James Model #80 is the *only* 8" Tilting Arbor Saw that has *ALL* these features:

★ Cast Aluminum Motor Mount
★ Cast Iron Ribbed Table
★ Steel Base with Cast Iron Sub Base
★ 2⅝" depth of cut
★ Self-Aligning Touch-Control Fence
★ Ball Bearing 45° Tilt Arbor

Compare the FEATURES! . . . and then — Compare the PRICE! You will agree that Darra-James, makers of over 200 Professional Power Tools, Accessories and Motors, offers more for the professional woodworker, and for the home craftsman.

FREE Mail Coupon today for Darra-James Catalog #14 and Literature on America's fastest growing Power Tool Line.

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P.S. Last minute news & notes...

AS THIS ISSUE went to press, the U.S. Defense Department and the Atomic Energy Commission released the most complete and reliable report to date on THE EFFECTS OF ATOMIC WEAPONS.

DON'T LOOK, they say, if an A bomb goes off anywhere near you. Drop to the ground as quickly as you can, if you are in the open, and curl up so as to shade your head, neck, hands, and other exposed parts of your body with clothing as much as you can. If there is a tree, doorway, or any other shelter only a step away, crouch there. But do not try to run far for cover. Hide from the light for at least 10 seconds.

THIS MAY SAVE YOU from serious burns. The heat from an exploding A bomb is so intense that it can cause casualties even among persons who are far enough away to survive exposure to the nuclear radiation.

AMERICAN HOMES, the experts fear, would not resist A-bombing any better than Japanese homes. But, if you are indoors, drop to the floor with your back to the window, or get under a table, desk, or counter--anything that may shield you from flying glass and debris--instantly. Stay away from windows for about a minute, since the shock wave continues for some time after the bomb has exploded.

A BASEMENT, especially if it extends beyond the main structure of your building, can offer some protection. Be sure, however, that there is a way out in case the building collapses or burns. Safest places elsewhere in most buildings are likely to be near interior partitions.

THE BALL OF FIRE that marks the spot where an A bomb has burst grows fast. A ten-thousandth of a second after a bomb of the type used in Japan has exploded, that ball of fire is 90 feet wide and--even at a distance of 5.7 miles--seems to be about 100 times as bright as ordinary sunlight. One second later, it is 900 feet in diameter.

IF THE BOMB goes off high in the sky, the radioactive contamination of the area afterwards is likely to be so slight that "little or no risk would be involved in ignoring it completely." At a low altitude, the area in the immediate vicinity would be uninhabitable immediately afterwards. But calculations show that a car going fairly fast might cross the area 15 minutes after the bomb went off without the occupants being harmed greatly.

UNDERGROUND, the experts continue, an A bomb would probably do less damage than if it burst in the air. No data are available on such an explosion, but it is believed that a nominal-size A bomb at a depth of 50 feet would move over 500,000 tons of earth, and leave a crater that would be 800 feet wide, 100 feet deep, and seriously contaminated.

AN UNDER-WATER EXPLOSION would not destroy as much of a city immediately as one in the air. But the radioactive contamination that would result might make a very large area--possibly 2½ miles wide--dangerously hot afterwards.

ONE THING that the scientists say you don't have to worry about yet is contamination of the whole world. Their calculations indicate that it would take 1,000,000 of the kind of bombs now known to be available to bring that about.

The Editors

What's NEW in Batteries?

AUTO-LITE Sta-ful BATTERY... *needs water only 3 times a year*

IN NORMAL CAR USE

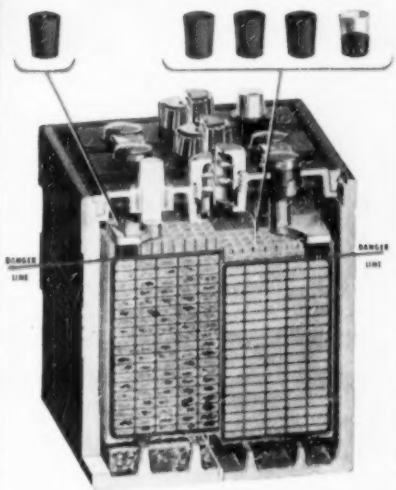
A revolutionary new development, the Auto-Lite "Sta-ful" Battery, protects you against a major cause of battery failure . . . damage to plates due to liquid loss. This new "Sta-ful" Battery Design permits a liquid reservoir with more than 3 times the reserve capacity of ordinary batteries . . . keeps plates fully covered and active months longer in normal car use.

In addition, "Sta-ful" gives you 70% longer average life* than batteries without Sta-ful features. Fibre-glass retaining mats protect every positive plate and keep the power producing material in place for maximum dependability. Get more for your battery dollars—replace with an Auto-Lite "Sta-ful" Battery. See your Dealer today.

AUTO-LITE BATTERY CORPORATION

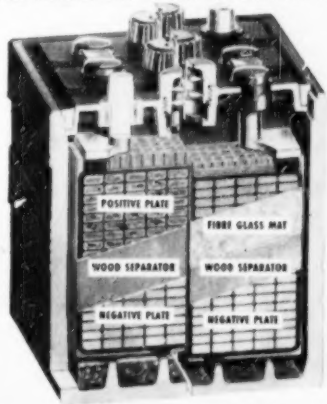
Toledo 1 Ohio

Because of its unique design and construction, the new Auto-Lite "Sta-ful" Battery holds more than 3 times the liquid reserve of ordinary batteries.



ORDINARY TYPE STA-FUL

Note how the protective Fibre-glass mat retains the power-producing material in the positive plate while ordinary battery plates shed the active material until it fills the sediment well.



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South Bend
Economy Model
DRILL PRESS

$76.00
f.o.b. factory
less
motor and chuck

RUGGEDLY CONSTRUCTED FOR MACHINE SHOP SERVICE

Write for Bulletin 402

Features include automatic belt tension, direct reading depth stop, full tilting table, rigid one-piece head casting, free-floating six-spline spindle, four pre-lubricated precision ball bearings, and adjustable feed tension.

Specifications: Drills to center of 14-1/4" circle, maximum drill size 1/2" in steel, spindle run out .005" or less, spindle square to table within .0075" in 5". Net weight of bench model shown, less motor and chuck is 124 lbs.

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SOUTH BEND 22, INDIANA
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$5 to $5

Manager Radio and Television Department

position as Television promotion of TV Installation Hauger, Calif.

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"Am doing Radio Servicing full time. Have my own shop and am making more money now than I ever did before. Owe this to N.R.I."—Curtis Staeth, Fort Madison, Iowa.

N.R.I. Graduate Doubles Salary

"I am employed by Station WKBO, as transmitter operator. Have more than doubled my salary since starting in Radio full time."—A. A. Herr, New Cumberland, Pa.

BE A SUCCESS IN RADIO-T

Learn by Practicin

Get a GOOD JOB--Have a BR in America's Fast Growing

Do you want good pay, a bright future, and security? Want your own profitable shop? Get into fast growing, prosperous RADIO-TELEVISION! Radio alone is bigger than ever. $1 million home and auto Radios, 2,700 Broadcasting Stations, expanding Aviation and Police Radio, Micro-Wave Relay, Two-Way Radio are making opportunities for Servicing and Communications Technicians and FCC-Licensed Operators.

Television is TODAY'S Good Job Maker

In 1949, almost 3,000,000 TV sets sold. By 1954, 20,000,000 TV sets estimated. 100 TV Stations now operating. Authorities predict 1,000 TV Stations. This means more jobs, good pay for qualified men.

I'll Train You At Home in Spare Time

Keep your job while training. Hundreds of successful RADIO - TV TECHNICIANS I trained had no previous experience, some only tion. Learn from illustr CAL EXPE multitester— common to all equip ment. Man N. R. trained me start the own profit able busines each year Many stu dents mak extra mone in spare tim while learni

Send

Cut out and my FREE You get a show how my 64-page cess in Radi my graduate equipment Cut out and age stamp President, Institute, W 37TH YEAR

Make Extra Money While Learning

Many of my students earn money fixing Radios in their Spare Time while learning, often average $5 to $10 a week. I send you SPECIAL BOOKLETS that show how to do it . . . and I send parts to build a MULTITESTER that helps you do it.

FIND OUT ABOUT THIS **TESTED WAY TO BETTER PA**

$10 to $15 Week Spare Time

"4 months after enrolling for N.R.I. course, averaged $10 to $15 a week in spare time servicing Radios." — W. Weyde, Brooklyn, N.Y.

Shop Specializes in Television

"Have my own shop. Am authorized serviceman for 5 large manufacturers and do servicing for 7 dealers." — Paul Miller, Maumee, Ohio.

Calls N.R.I. His "Stepping Stone"

"N.R.I. has been my stepping stone from a few hundred to over $4,000 a year as a Radio Engineer. Make extra money servicing Radios."—Alton B. Michaels, Trenton, Ga.

Takes Course

I TRAINED THESE MEN

Read What They Are Doing and Earning

-TELEVISION

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BRIGHT FUTURE
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only a grammar school educa- earn Radio-Television principles llustrated lessons. Get PRACTI- EXPERIENCE—build valuable ester—experiment with circuits n to Radio and Television. Keep quip- Many R. I. men their profit- usiness year. stu- make money e time earning.

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t and mail postcard at right for REE DOUBLE OFFER Now! et actual servicing lesson to how you learn at home. Also page book, "How to Be A Suc- Radio-Television." Read what aduates are doing, earning; see ent you practice with at home. t and mail postcard . . . no post- amp necessary. J. E. SMITH, ent, Dept. OJP3, National Radio te, Washington 9, D. C. OUR YEAR.

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J. E. SMITH, President National Radio Institute

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Send now! This card entitles you to actual lesson "THE ABC's OF SERVICING." It shows how many pictures and diagrams are used to make learning at home easier, practical.

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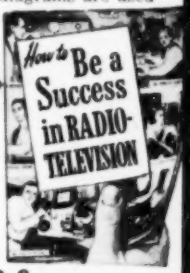

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TRAIN AT HOME IN SPARE TIME

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MUSICAL COMEDY STAR – *N*
Fabray: "As
welcome Ca
ness and flavo

BOSTON RED
pitcher, *Mel P*
"I'd walk a mi
a Camel, any ti
great-tasting sm

RIFLE CHAMPION
Audrey Bockmann:
"Camels certainly score
a hit with my taste.
And they're so mild!"

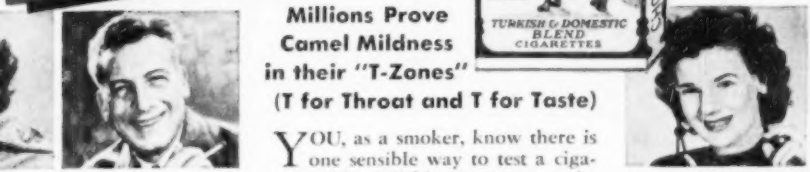
DISC JOCKEY *Bob*
Maxwell: "My voice
gets a steady workout.
My throat welcomes
Camel mildness."

RADIO SONGSTRESS
Fran Warren: "Camels
are mild! My 30-Day
Test proved they agree
with my throat!"

EL MILDNESS with my throat he start!", re- ousewife *Mrs. e Kinney.*

HOW MILD CAN A CIGARETTE BE?

Smoke Camels and See!



KE a pack of day. Every stes good! ls for me!" *R. ie,* Personnel dir.

PION *Bob* *nann:* voice y score rkout. taste. comes mild!"

EZIO PINZA, former star of "So. Pacific": "I smoke the cigarette that agrees with my throat – Camel!"

TELEPHONE OPERATOR *Ethel James:* "In my job, cigarette mildness is important. Camels are my smoke!"

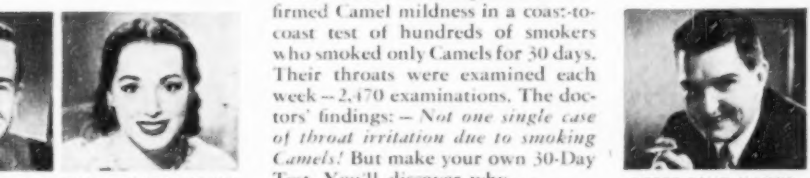
Millions Prove Camel Mildness in their "T-Zones" (T for Throat and T for Taste)

YOU, as a smoker, know there is one sensible way to test a cigarette. The reliable test is to smoke pack after pack. That's why many smokers have made their own Camel 30-Day Mildness Tests.

And noted throat specialists confirmed Camel mildness in a coast-to-coast test of hundreds of smokers who smoked only Camels for 30 days. Their throats were examined each week – 2,470 examinations. The doctors' findings: – *Not one single case of throat irritation due to smoking Camels!* But make your own 30-Day Test. You'll discover why...

MORE PEOPLE SMOKE CAMELS THAN ANY OTHER CIGARETTE

R. J. Reynolds Tobacco Co., Winston-Salem, N. C.



TELEVISION STAR *Marguerite Piazza* agrees: "As a singer, I enjoy Camel mildness. Camels taste grand!"

PETER LIND HAYES, comedian: "I found what mildness means when I made my Camel 30-Day Test!"

STRESS Camels 30-Day agree

RALPH BELLAMY, noted actor: "Throat irritation doesn't go in show business. Camels agree with my throat!"

"I'VE JOINED the millions of smokers who'd walk a mile for a mild Camel!" *Ann O'Rourke,* secretary.

"I'VE SMOKED mild, cool Camels for 20 years. Camel flavor suits me to a 'T'." *G. Campbell,* sportsman.

PATRICIA MORISON, musical comedy star: "Yes, I made my own 30-day Camel mildness test. It was fun."